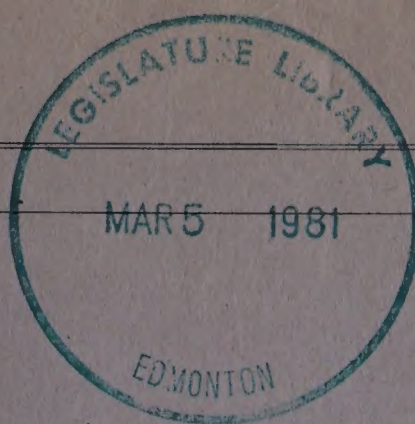


CA2ALQG
50H20
Sept 11/51
Vol 2



The Province of Alberta

PETROLEUM AND NATURAL GAS CONSERVATION BOARD

IN THE MATTER OF THE GAS RESOURCES PRESERVATION ACT

AND IN THE MATTER of a Joint Hearing to determine various questions
relating to the proposed Export of Natural Gas from the Province of Alberta.

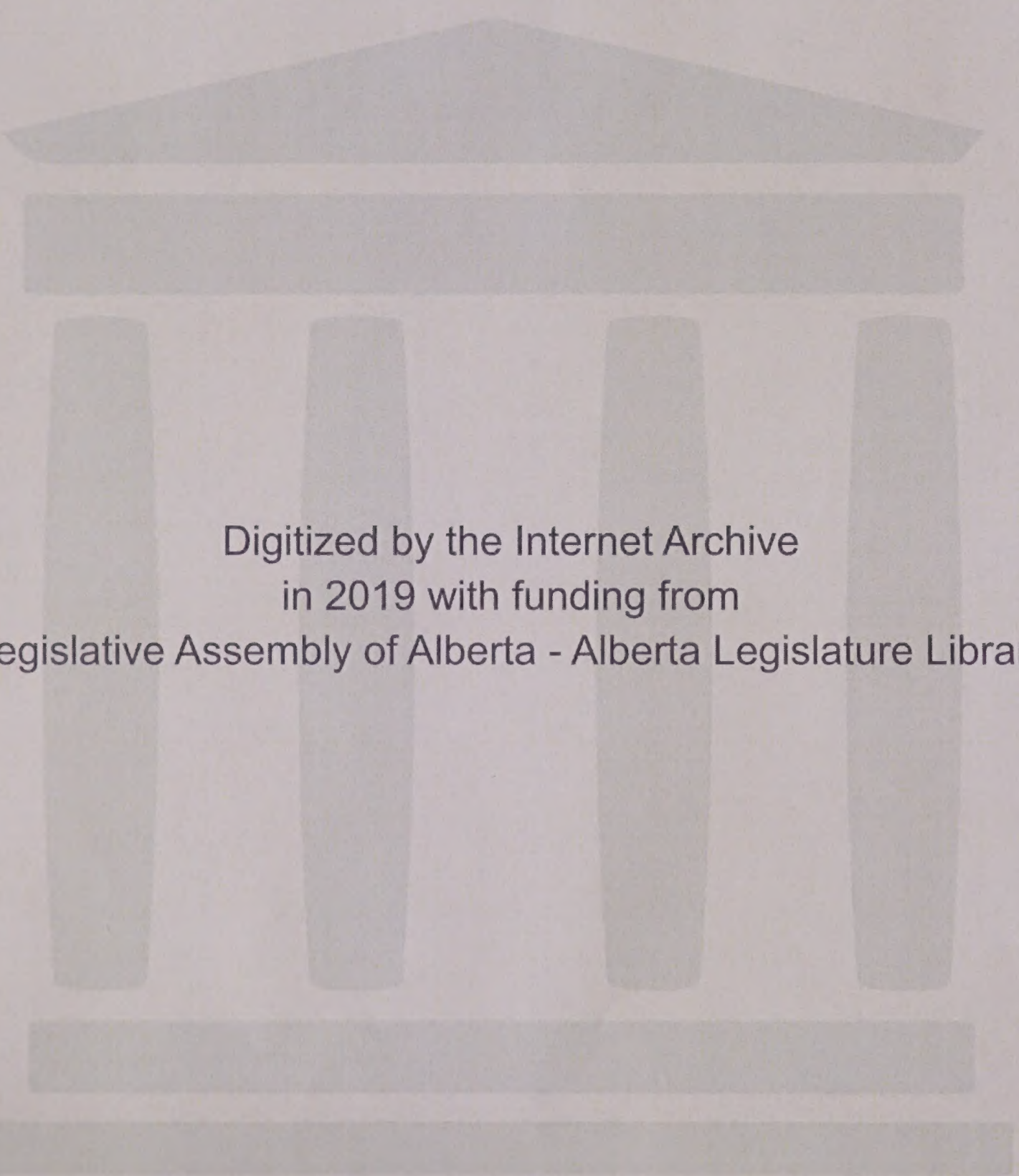
I. N. McKinnon Esq., Chairman

D. P. Goodall Esq.

Dr. G. W. Govier

Session: SEPTEMBER 11th, 1951.

Volume 2



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I N D E X

VOLUME 2.

11 September 1951.

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THE CHAIRMAN:
examine Dr. Nauss?

Does anyone wish to cross-

MR. C.E. SMITH:

I think, sir, there is one
other representative who should be recorded as being
here this morning, Mr. parmalee for Northern Natural
Gas.

DR. A. W. NAUSS (recalled)

already sworn, cross-examined by Mr. Steer:

Q I have some questions to ask Dr. Nauss, Mr. Chairman.
Dr. Nauss, you recall in your Table "A" revised, which
was made Exhibit J-30 at the Joint Hearing, you made
an estimate of 6570 billion feet of marketable gas, is
that right?

A In where?

Q J-30 of the Joint Hearing. J-30 is the table and J-29
is the report.

A I did not hear your question.

Q I say, you made an estimate in that J-30 of 6570 billion
feet of marketable gas?

A And the question?

Q I beg your pardon?

A What is the question?

Q I am asking you if that is correct?

A I believe it is, sir, yes.

Q You have not it in front of you?

[illegible]

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A No, I do not.

Q I will just show it to you. The reason I want to verify that, Dr. Nauss, is that it is a very simple matter to make mistakes with regard to these figures. The very last column, it is headed "Marketable Gas" and it adds up to 6570 billion cubic feet, is that right?

A Yes.

Q And in the report that was submitted yesterday as Exhibit 4 you give 7811 billion feet of recoverable gas?

A Yes.

Q Are they intended to be the same thing?

A The same type of thing, yes.

Q So that your 7811 in Exhibit 4 is intended to compare with 6570, is it, in J-30 of the Joint Hearing?

A That is correct, yes.

Q Yes. So that you might just as well have used the word "marketable" instead of the word "recoverable" with reference to the 7811?

A With one difference. During the last Hearing there was some objection raised in regard to location of this gas and so I thought the word "marketable" was a poor word to use as the heading for that column because distantly located volumes of gas could not be considered as marketable. That is the only difference.

Q Distantly located fields could not be considered as marketable, and consequently you got into the 7811, have you, some gas which can not be described as marketable, is that right?

A Some gas which is inaccessible at the present time.

Dr. A. W. Nelson
 Dr. E. J. Nelson

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A: I do not.
 Q: I will just show it to you. The reason I want to verify that, Dr. Nelson, is that it is a very simple matter to make mistakes with regard to these figures. The very last volume, it is headed "Marketable Gas" and it adds up to 8370 billion cubic feet, is that right?
 A: Yes.
 Q: And in the report that was submitted yesterday as Exhibit 4 you give 7811 billion feet of recoverable gas?
 A: Yes.
 Q: And they intended to be the same thing?
 A: The same type of thing, yes.
 Q: So that your total in Exhibit 4 is intended to compare with 8370, is it, in 1-26 of the Joint Hearing?
 A: That is correct, yes.
 Q: Yes. So that you might just as well have used the word "recoverable" instead of the word "recoverable" with reference to the 7811?
 A: With one difference. During the last hearing there was some objection raised in regard to location of this gas and so I brought the word "recoverable" was a poor word to use as the heading for that column because distinctly located volumes of gas could not be recovered as recoverable. That is the only difference.
 Q: Distinctly located fields could not be recovered as recoverable, and consequently you got into the 7811, have you, some gas which can not be described as recoverable?
 A: Some gas which is irretrievable at the present time.

Dr. A. W. Nauss,
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Q In other words, it is not pipeline gas at all?

A No, I would not make that statement.

Q Pardon?

A I would not make that statement.

Q Is it pipeline gas at the present time?

A There is a lot of it is not pipeline gas today.

Q And do you think that what the Board is interested in is what is pipeline gas at the present time?

A I think they are, yes.

Q That is their real problem, isn't it?

A And what might be pipeline gas in the near future.

Q Yes. You have not distinguished them?

A No, I have not. That has been left to a future witness.

Q Oh, I see. Now, is all this 7811 billion feet that you refer to sweet gas?

A No.

Q Has there got to be a discount factor applied in order to reduce it to sweet gas?

A No.

Q Well then, is it sweet gas?

A The discount factor has been applied.

Q So that what you are contending is that your whole 7811 billion feet is sweet gas and ready for market?

A Yes, that is right.

Q That is right?

A Yes.

Q I see. Now, you read the Board's report where they adopt a figure based on the evidence given at the Joint Hearing of 4658 billion feet?

A Yes.

Dr. J. K. Wilson
Dr. J. K. Wilson

Q In other words, it is not pipeline gas at all.

A No, I would not make that statement.

Q Perhaps?

A I would not make that statement.

Q Is it pipeline gas at the present time?

A There is a lot of it in the pipeline gas today.

Q And so you think that what the Board is interested in

is what is pipeline gas at the present time?

A I think they are, yes.

Q That is what they are interested in, isn't it?

A And what about the pipeline gas in the near future?

Q Yes, but not distinguished from

A No, I have not. That has been left to the Board to decide.

Q Yes, I see. Now, is it this Bill that says that you

refer to what you

A No.

Q Has there not been a discount factor applied in order

to reduce it to what you?

A No.

Q Well then, is it what you?

A The discount factor has been applied.

Q So that what you are suggesting is that your whole 700

million feet is what you are ready for market?

A Yes, that is right.

Q That is right.

A Yes.

Q I see. Now, you read the Board's report where they

adopt a figure based on the evidence given at the time

hearing of 700 million feet?

A Yes.

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Q And on page 15 of the Report the Board refers to that as disposable, and on page 17 they refer to it as established reserves. Now, I suppose that you will agree that that means presently marketable pipeline gas. Do you think that is what the Board means?

A Well, I think that figure also included some gas they would consider unavailable.

Q Yes. I think it included perhaps some that was said to be beyond economic reach. We will just see what they did say:

"As a comparison, the Board's estimate of reserves of disposable gas in the Province including 219 billion cubic feet beyond economic reach and excluding certain small reserves of less than 5 billion cubic feet is 4658 billion cubic feet."

Now, to get the Board's idea of present marketable gas, I take it that we would deduct 219 from 4658 because of that quantity being beyond economic reach. Do you think that would be right?

A They classify 219 as being beyond economic reach and that would have to be deducted to get that amount of gas which they consider as within economic reach.

Q Now, when you were starting on this report, Exhibit 4, did you start with 6570 billion as found in J-30 or did you start with 4658, as found by the Board?

A I did not start with any figure.

Q I see. So that it is true to say that you did not take this report and, referring to the Table found on page 19, take the quantities which the Board found as

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established reserves for local use, general use, or beyond economic reach, and start from there for the purpose of determining what had happened since the first of January this year that should alter the Board's views?

A No. What I did was calculate the reserves of each field and add them up.

Q Yes. So that what we have got in your Exhibit 4 is your opinion as to the present reserves, notwithstanding anything that the Board has found on the basis of the evidence adduced before it, that is right?

A Yes.

Q Now then, starting with your 6570 and looking at the situation at the date of your Exhibit 4, what quantity of gas ought to be added to your 6570 of marketable gas to bring your estimate of marketable gas up to this date? What quantity should be added?

A The difference between those two figures is approximately 1 trillion 300 billion.

Q Yes, and if we were to assume that a trillion 300 billion had been added by investigations made since the first of January this year, and you added that to the Board's 4 trillion 658 billion, that would be the result?

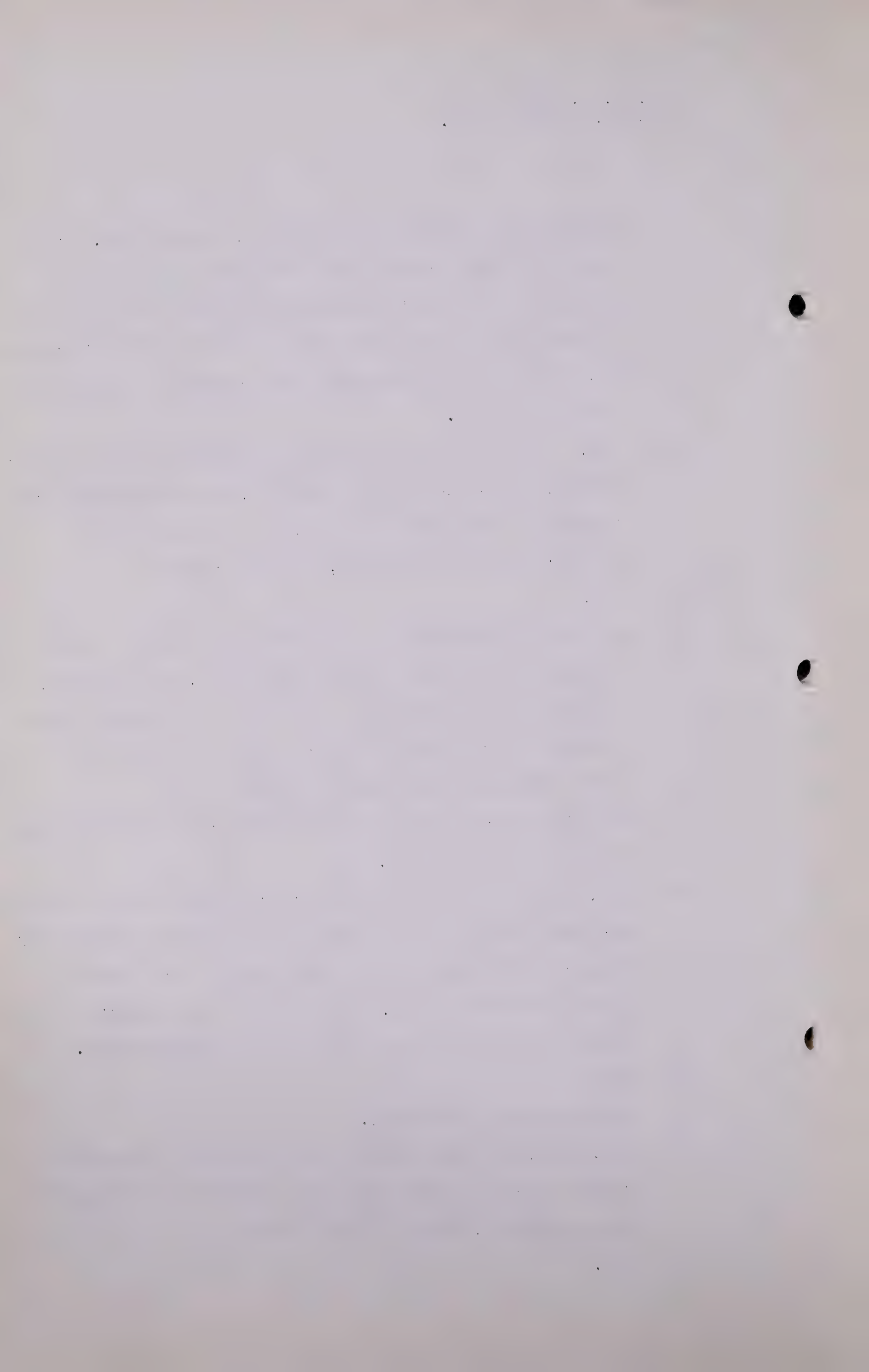
A You would get 5 trillion 958 billion approximately.

Q Yes?

A Approximately 6 trillion.

Q Yes. Now, you have included in your 7811 in Exhibit 4 fields which were not before the Board when writing its interim report, that is quite clear?

A Yes.



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Q Yes. Now, will you confine your attention to the fields which were before the Board, and you told us that you did not start with those fields but have made what you describe, I think, as a re-survey, is that right?

A A revision of previous reports.

Q But you told me you did not start with Table "B", you told me you did a re-survey. Now, which did you do?

A It is a revision of previous reports submitted here. In other words, those fields in which no additional drilling had been done were not recalculated.

Q I see. So you took "A" - - I think we can ignore Table "A", can not we, and confine our attention to Table "A" revised, which is J-30. You would not go back of J-30?

A No. We can confine our attention to this right here.

Q No, but I can not because I want to know what your answer means. You say, I think, that where no new drilling had been done in a field you adopted the figure that was found in J-30?

A That is right.

Q And you revised your figures in J-30 only in cases where in that particular field, which is referred to by the Board, subsequent drilling had been done?

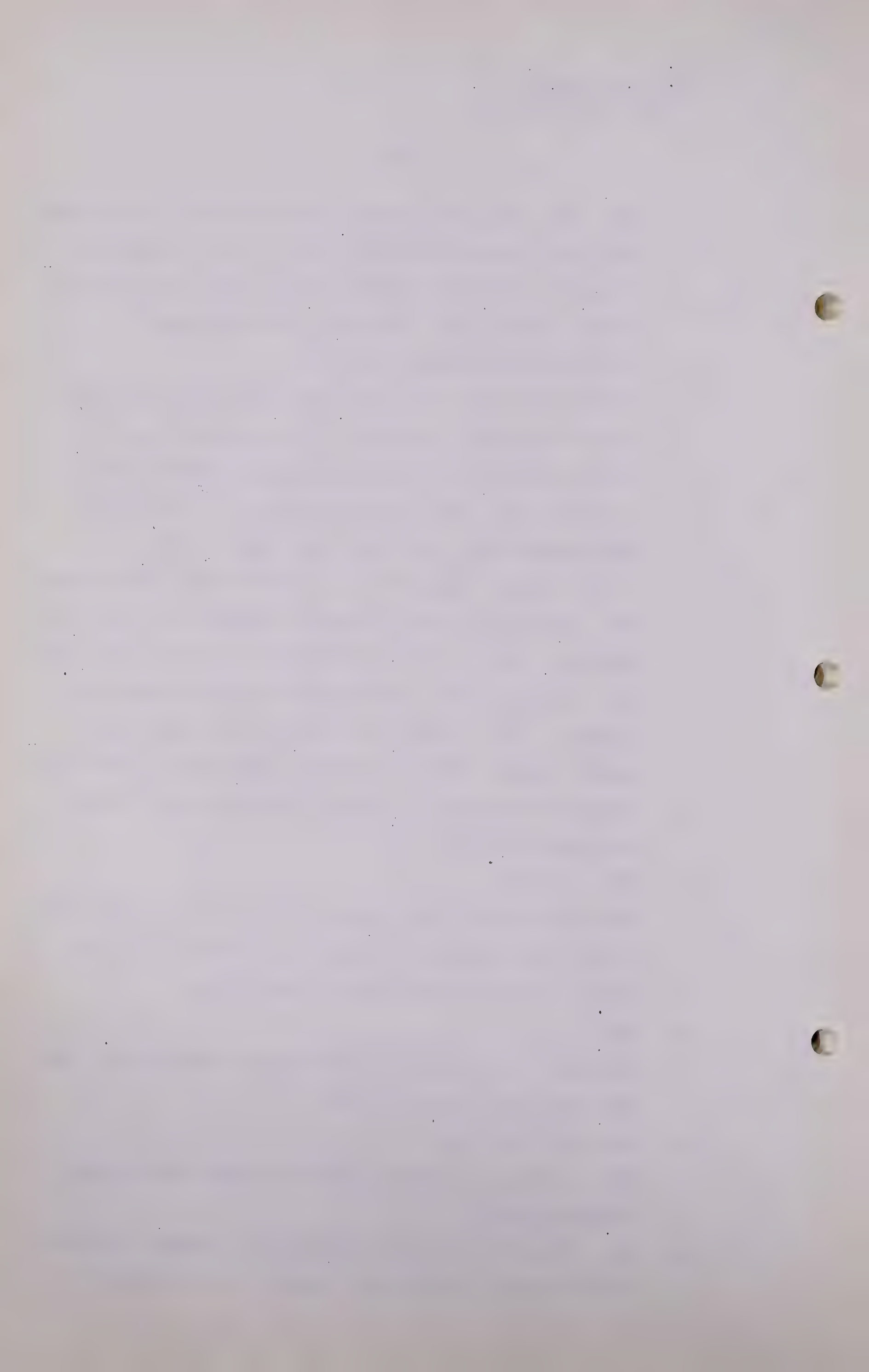
A Yes.

Q Yes, and if no subsequent drilling had been done, then you used the figure in J-30?

A Yes, that is right.

Q But you did not use the figure that was used in the Board's Report?

A No. There is just one modification on that, and that is the slightly different treatment in this Report,



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which modifies the figures a few per cent, 1 or 2 per cent due to the different treatment in this report.

Q Yes?

A In other words, we calculated the gas in place this time and applied a recovery factor. Previously we calculated the gas to 100 pounds abandonment pressure and then applied a recovery factor.

Q And what did the Board do? The Board took it down to 100.

MR. McDONALD:

Page 19.

Q MR. STEER:

The Board has estimated gas in place in column 10 on page 19?

A Yes, that is right. I would say that the difference in this presentation over that of J-30 is that we calculated the gas in place this time.

Q Yes, and if you were going to calculate it down to an abandonment pressure of 100 pounds it would be considerably less than the 7811?

A No, it would be considerably more.

Q It would be more?

A Yes.

Q Will you tell us why?

A Because the amount of gas in place this time is 10 trillion 420 billion, and if you deduct about 90 per cent of that, which is the approximate amount of the gas available down to 100 pounds, you would get about 9 trillion rather than 7.8.

Q Now, by gas in place, I take it, Dr. Nauss, you mean all the gas there is in the particular area?

A That is right.

Dr. A. W. Nauss,
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Q All right. And do you say that all that gas will be taken out if you produce the field down to 100 pounds pressure?

A No, I do not.

Q Do you say that considerably less than the gas in place would be taken out down to 100 pounds pressure?

A Approximately 90 per cent, because the average of these pressures is around 1,000 pounds.

Q All right. Now, if you calculate your 7811 as gas in place and then re-compute it down to 100 pounds abandonment pressure, I am suggesting that you are going to get less than 7811 billion cubic feet. Is that right or not?

A No, it is not, you get more.

(Go to page 96)

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MR. McDONALD: The gas in place is a different thing.

Q MR. STEER: Now, then, you have told me that assuming that the Board's figure of 6570 billion is correct, the Board's figure of 4658 billion is correct, that on your figures the Board ought to add 1300 billion to that, is that right? If the Board is going to start with its previous figure, then according to you the amount they should add would be 1300 billion cubic feet?

A Yes.

Q Yes?

A There is one other item, they did not include some of the fields that I included here.

Q Yes. I am only talking now about the fields that the Board dealt with in this report, and then what you contend, you have evidence of what has been discovered since, whether it is in those old fields or in the new fields, the total amount that the Board ought to add, assuming you to be correct, is 1300 billion?

A Yes.

Q Yes. How much of that 1300 billion do you regard as proved gas as distinct from probable gas?

A I do not make the distinction.

Q And won't make it?

A It is a meaningless distinction so that I see no point in it.

Q I see. Now, let me refer you for a moment to that Morinville map on page 29, following page 29. You have revised downwards very considerably your Morinville figures?

A Yes.

Q That is correct?

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A Yes.

Q And you gave evidence before the Board at the Joint Hearing that that Morinville field would extend by what you have indicated as its present boundaries by the black line around the word "Morinville" by drawing a line from the top of that outlined area over to the Calahoo well and back again from the Calahoo well to the bottom of that outlined area?

A Yes.

Q Am I right in that?

A Yes, that is correct.

Q And your evidence before the Board on the last occasion was that that area....

A Was 39,000 acres.

Q ...of 39,000 acres contained, would contain 784 billion feet of marketable gas, is that right?

A Yes, that is right.

Q And you told the Board that that was proved and probable gas, did you?

A Yes.

Q And that there was no distinction between the two?

A I do not believe I made that statement.

Q Well, you have made it now?

A Yes.

Q Yes? So that when you said proved and probable gas of 784 billion in that area at the Joint Hearing, you meant that the Board was to take that as 784 billion feet of proved gas?

A And probable.

Q Now, you say you intended the Board to take it as proved and

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probable, did you? Is that right?

A That I intended the Board?

Q You intended the Board to take your meaning to be that you had 784 billion cubic feet of proved and probable gas, is that right?

A Yes.

Q Yes. And did you intend the Board at that time to draw any distinction between proved and probable? You can answer that question, Dr. Nauss, can't you?

A I had no intentions whatsoever on the matter. The Board could draw their own conclusions.

Q Well, then, why, if proved and probable today means proved...

A No, I did not state that.

Q What did you say?

A That there is no distinct boundary. There is no clear distinction between reserves we class as probable and reserves we class as proved. There is no sharp line. The two categories grade into one another.

Q I see?

A As you get more and more information on the probable reserves, they gradually become proved. There is no sharp, sudden line at which time they come into proved reserves.

Q I wonder if you would agree with this. I am reading from what Mr. Liesemer had to say in Exhibit J-41 at the Joint Hearing, where he said this;

"The division of reserves into proved, probable and possible has been discarded in favour of the American Gas Association Committee definition that every discovery proves a gas reserve."

Dr. A. W. Nauss,
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Now, I suppose we can all agree with that?

A Every discovery proves there is some gas there, yes.

Q Yes, certainly. I think we can all agree with that.
With the proviso as inserted by this American Gas Association Committee, "that care should be exercised to limit the area to that proved beyond a reasonable doubt." Do you agree with that?

A Welll they are poor words. They are as meaningless as the word "probable" is in the first place.

Q I see?

A proved beyond a reasonable doubt, what do you mean?

Q I mean so that you, as an expert geologist, would not have any doubt about the accuracy of your answer?

A Well, here is the point, in calculating oil reserves, it is not as accurate as measuring the length of a piece of iron, nor is it as accurate as surveying.

Q Oh, I think we all agree with that, Dr. Nauss.

A In other words, even proved reserves are a matter of estimating.

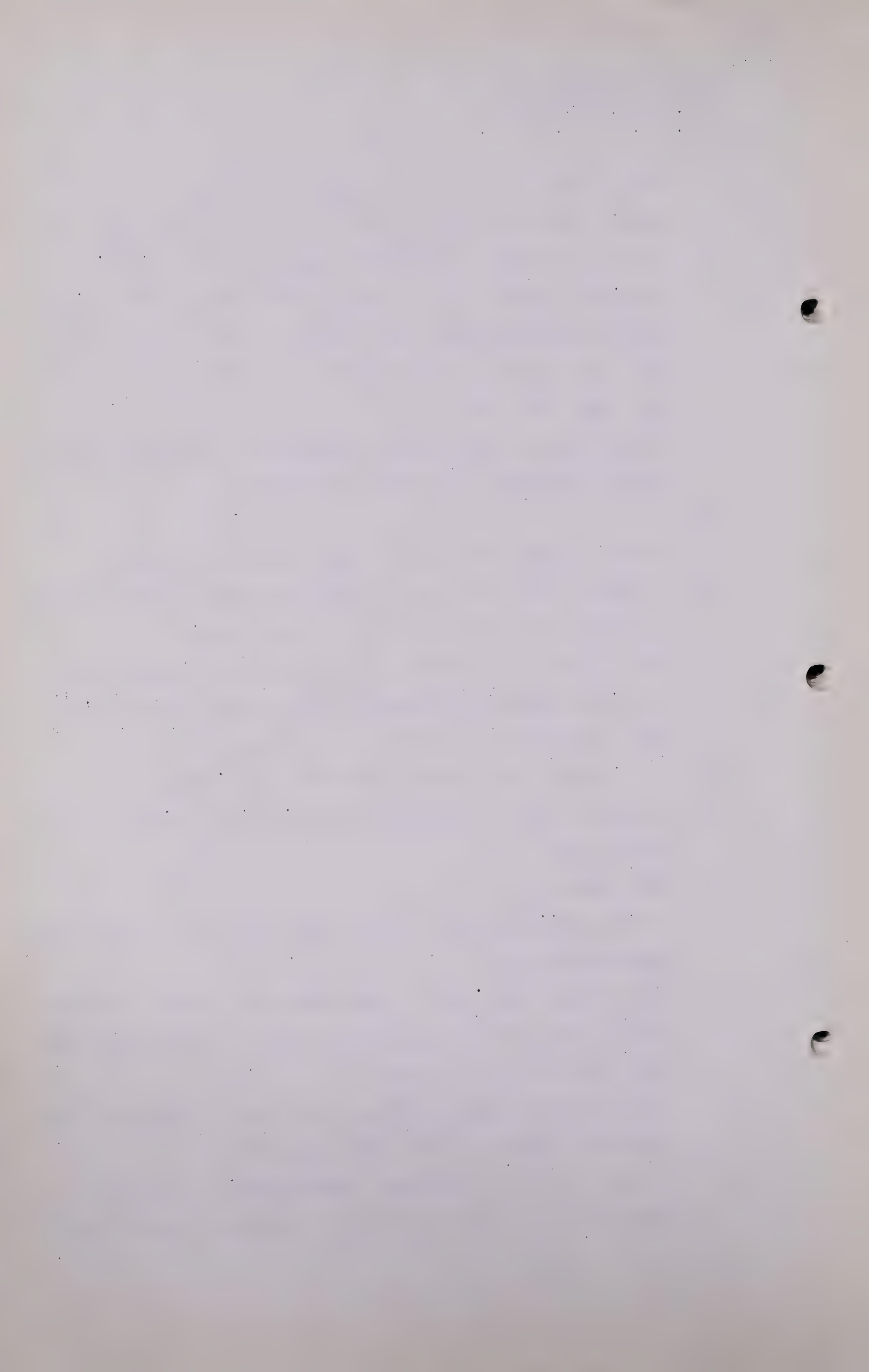
Q Now, then....

A So that you might say, "Well, then, reserves are not really proved after all".

Q Did you have any doubt in your mind when you gave us 784 billion feet for that Morinville field, as to whether that was a proved reserve or not?

A I knew that the normal risks of the oil business were involved in drilling within that area, yes.

Q And the result of subsequent developments is that 784 billion in that field has now been reduced by you to 217?



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A That is right.

Q And you won't go with me on the proposition that the American Gas Association was right in saying that a geologist in estimating proved reserves should have an opinion beyond a reasonable doubt that his estimate was correct?

A Yes, he should have an opinion.

Q Yes?

A The thing I want to point out is that when you say "beyond a reasonable doubt" you are - in whose mind? You are bringing in a human mind.

Q In yours, in your mind?

A All right. Well, then my proved reserves will be different than somebody else's.

Q Well, certainly, because it can only be a matter of opinion, can't it?

A That is right.

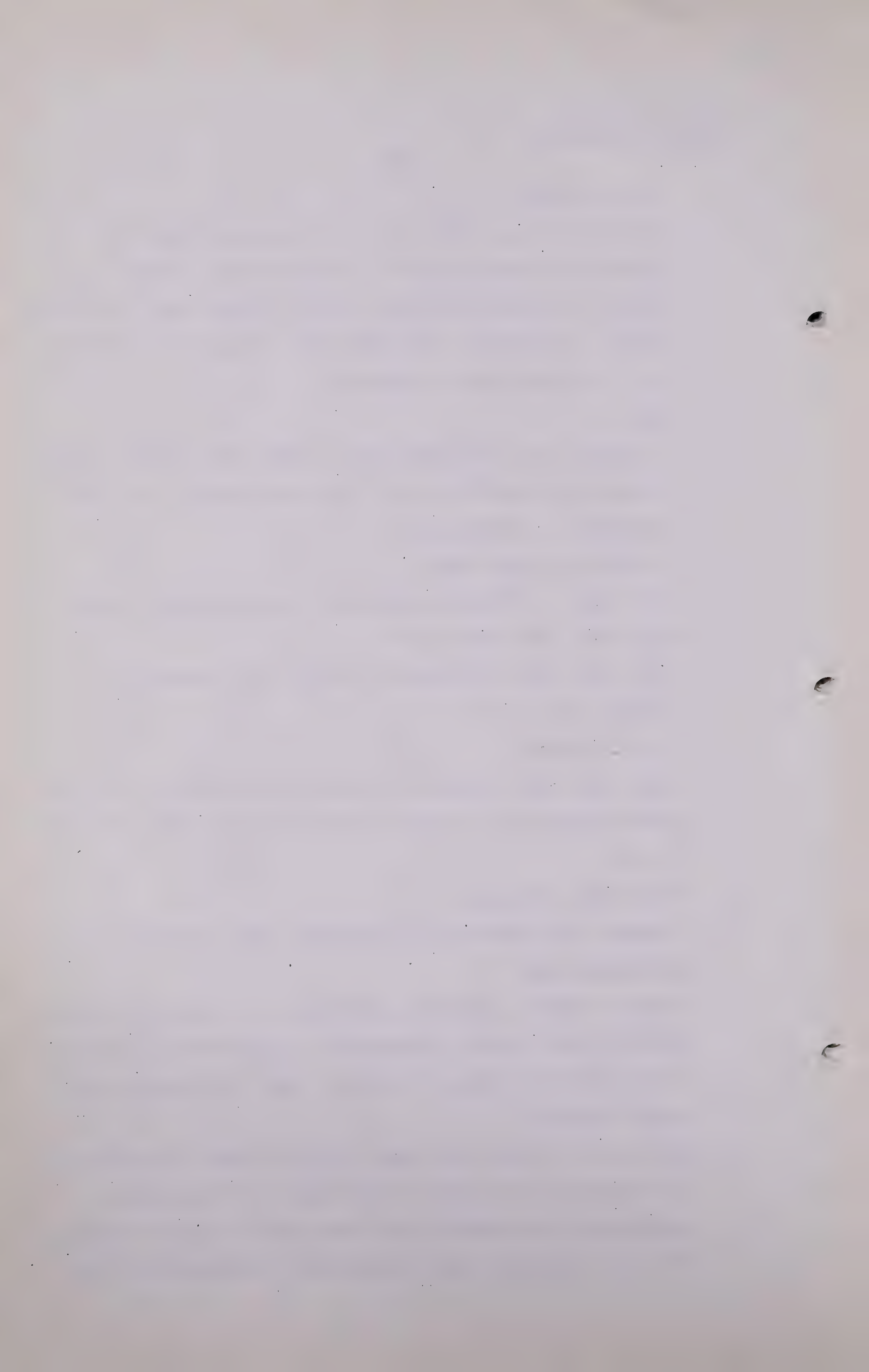
Q Yes. Now, when you gave the Board 784 in J-30, I want to know whether you intended the Board to take that as proved or not?

A Proved and probable.

Q Because you described it, Dr. Nauss, you described it as marketable gas?

A That is right. In applying marketable to these estimates, when you use the word "marketable" to describe a category on top of an estimate, it does not make that estimate any more accurate.

Q No, no, not at all, but what I want to know is what was in your mind when you gave us the figure of 784, because subsequent developments have shown that it was so excessive. Now, how could you possibly describe the Morinville area



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as containing 784 billion cubic feet of marketable gas?

A It still might contain more than 784 billion right today.

Q Yes, but you say.....

A Because there is an excellent possibility of it extending northward.

Q Yes, but you say today that it contains 217?

A That we can point out 217.

Q Yes?

A Because there have been five wells drilled in that area.

Q Yes?

A But it would be very easy to join that Morinville area northward. There is a very strong suggestion that the Morinville pool extends northward rather than westward.

Q But you have not dealt with it, or have you dealt with it, in your report?

A No, I haven't dealt with it, so that my figure of 784, I thought there was a reasonable chance of it existing. It still might exist there.

Q Well, that means, Dr. Nauss, that a great part of that 784 in your mind was possible gas at that time, doesn't it?

A I think that we should be on a different plane in calculating gas reserves for this purpose when we realize that pipeline people do not spend money unnecessarily. They are not going to go out and prove up gas, they are not going to prove up gas if there is not a possibility of selling it, so that I think that we should have just a little bit of vision in calculating these things.

Q I am not quarrelling with vision, Dr. Nauss, but people do not invest money on visions, do they?

Dr. A. W. Nauss,
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A No, they do not, so that we have ample protection from that point of view.

Q In other words, a man that is going to invest his money in this project is going to get a different opinion from the opinion which you have put before the Board, your visionary opinion that you put before the Board, is that right?

A I do not think so, no.

Q Well, Doctor.....

A It is merely a matter of understanding. I probably have not made a clear description of the nature of this information. It is merely a matter of understanding the nature of the information on which this estimate is based.

Q Yes? And from the evidence that is put before the Board its task, as far as it is humanly possible, is to determine what quantities of marketable gas there are in the Province, is that right?

A Yes.

Q And in order to assist the Board in arriving at this Joint Hearing, mind you, which was the subject matter, the only subject matter of the inquiry, you put before the Board 784 billion feet of marketable gas in Morinville for the purpose of leading the Board to conclude that that was correct, isn't that so?

A You should not have used the word "correct", that that was correct.

Q That that was your opinion?

A That that was my estimate.

Q Pardon?

A There is a difference between what is accurately correct and

Dr. A.W.Nauss,
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what is an estimate.

Q What I should have said was that that is your best opinion as to the marketable gas in the Morinville area?

A And it still may be right.

Q And it still may be right?

A Yes.

Q But you won't pledge your opinion to it today because you have reduced it down to 217?

A Because of the drilling of one dry hole within the area.

Q Yes. And I am going to ask you this, Dr. Nauss, whether you would give me an idea as to what quantity of your 1300 billion feet that we have referred to you would regard as proved beyond a reasonable doubt?

A I answered that question before.

Q Well, please answer it again?

A I do not make any distinction between proved and probable reserves in this case because....

Q No, that is not my question. My question is, what, in your opinion, of that 1300 billion feet do you regard as proved beyond a reasonable doubt?

A Let me make this statement, that the Board can depend upon the existence of at least that 1300 billion cubic feet, because there will probably be more.

Q Discovered in other fields?

A Discovered in other fields?

Q Or discovered in these fields that you have discussed with me?

A Discovered in these fields that we have discussed.

Q And not in new fields?

A Not in new fields, yes.

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Q I see. So that, in your opinion, the Board can say that the quantities of gas that are set out by you in this report are proved, from the fields to which they are related?

A You see, I made this statement...

Q Please answer that question, Doctor?

A Would you repeat it? I did not hear it clearly?

Q Yes. Can the Board depend on this being your opinion that the quantities of gas that are stated by you in relation to the particular fields dealt with in your report are proved with respect to those fields?

A Within the limits of our ability to calculate reserves based on this type of data, yes.

Q I see. Just to make that quite clear, your answer is that with respect to the Acheson field, for example, on page 6, there will be 26.9 billion cubic feet of gas marketable for the purposes of the Board's inquiry?

A Yes.

Q You say that is proved?

A 25 billion.

Q Well, I am looking at page 6, and I see 8.8 and 18.1, a total of 26.9?

A That adds up to it.

Q I beg your pardon?

A That adds up to 26.9, that is right.

Q Yes. Did you, in your Plate adopt 25?

A No, 26.9.

Dr. A. W. Nauss,
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Q I see by your statement that that is proved gas?

A At the previous hearing I made a mis-statement which I believe you have overlooked, stating that there was difficulty in calculating the reserves of these fields and that on some of them I might be quite a bit high, but owing to the fact that we were dealing with a large number of fields that where I was too high on some of them I would be too low on others and the thing would all even up.

Q And that is the statement you want to make now?

A Yes.

Q And somehow the Board has got to rely on that averaging before it can accept as your evidence the 1300 billion cubic feet as your guess?

A It is something that the Board should certainly take into consideration.

Q Now, I am going to ask you about Baxter Lake on page 7 of your report. You give recoverable gas 1.9 billion cubic feet. Have you got enough evidence to justify the opinion that that is proved?

A Within the limits of our ability to calculate gas reserves, yes.

Q And there is not any other computation in this book, Exhibit 4, with respect to which you will not make the same answer that within the limits of your ability, and I am asking if you have enough evidence to justify your conclusions?

A What you are trying to show, Mr. Steer, is that the calculation of gas reserves is like surveying. It is not. It is an estimate.

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Q I can shorten that by saying that I have no such idea in my mind. I am trying to find out how you came to these conclusions as to proved or possible gas reserves. In Exhibit 4 you are dealing with possible or potential or proved gas reserves?

A Yes.

Q And the other figures are intended to indicate proved gas reserves, is that right?

A The other figures are intended to indicate proved and probable gas reserves.

Q And you will not make any distinction between "proved" or "probable"?

A I want to be more accurate. I want to show the evidence that is available to me, because you might have very good information on one field on one point and the evidence on other fields is different.

Q Yes?

A As I say, you might have very good evidence on one and have poor evidence on another. In one case I might have a drill stem test and no core analysis. On another we will have a core analysis and drill stem tests and electrologs and core descriptions and everything. Those are the things which distinguish between the reliability of reserve calculations.

• Q Those are the things I am suggesting to you which distinguish the proved and probable reserves.

A There are 15 items which enter into calculations of gas reserves. Do you think where I have more than 7 that I should use the word "proved" and where there are



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less than 7 I should use the word "probable"?

Q If you are asking my opinion I should think that you should have all the information in order to calculate your gas reserves.

Q MR. McDONALD: And when is that information available?

A You do not have all the information available as to the amount of gas in a particular field until all the gas has been produced and then the calculations are of no value.

Q MR. STEER: Then can we say that with respect to the what you call "proved reserves" your information is stronger than the information you have as to "probable reserves"?

A Yes.

Q But you say to the Board that it has just to take all of the gas, the proved gas reserves, but you cannot draw a line of distinction as between proved and probable?

A No, I don't. I am classifying this as all proved and probable.

Q What you are saying is that where it is proved gas you have stronger evidence?

A Yes.

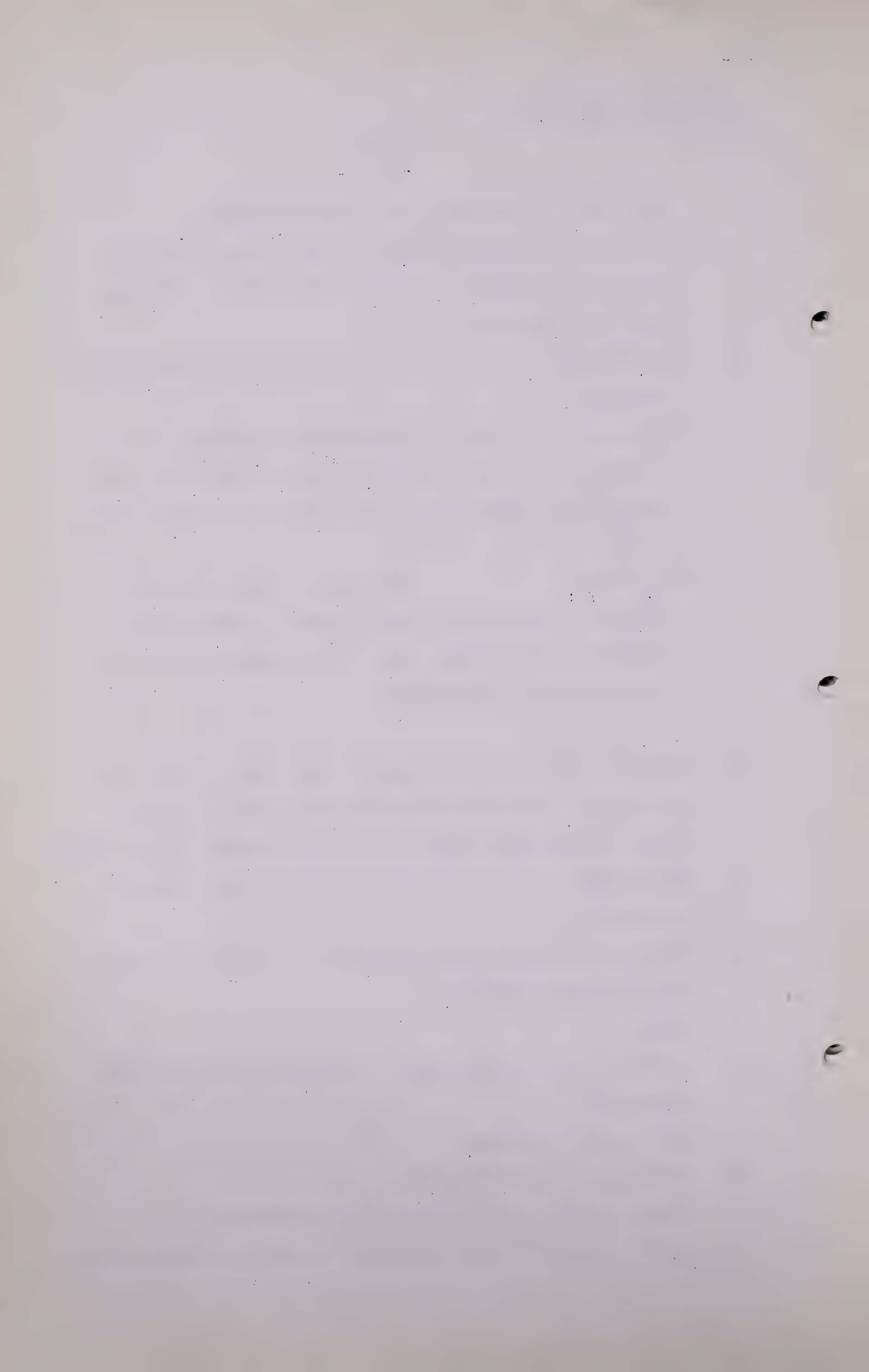
Q As far as the probable gas is concerned you have weak evidence?

A Let us not say "weak".

Q Then shall I say "weaker"?

A In the probable we have not as much evidence.

Q Which indicates weaker evidence is available with respect



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to that particular field?

A Yes, it is weaker evidence.

Q And you are not prepared on that basis to divide up your 1300 billion, are you? Is that right?

A It could be divided up in such a manner.

Q I suppose it would take some time to do so, would it?

A It would not take so long.

Q Have you any idea what the approximate result would be? Would it be half and half?

A I do not know.

Q Because what I am suggesting is that on your evidence with regard to a lot of these single wells you have got in your report and with regard to a number of the fields you have got it is pretty sketchy, - your information is pretty sketchy, do you agree with that?

A No, I don't. In regard to the single wells the total reserve from the single wells does not add up to such a large figure.

Q Will the Board excuse me for a moment? Now, Dr. Nauss, will you look at the Acheson and Baxter Lake again? In Acheson without any drill stem test you have got 26.9 billion from the two sands?

A In Acheson there are dozens of drill stem tests.

Q They are not given here?

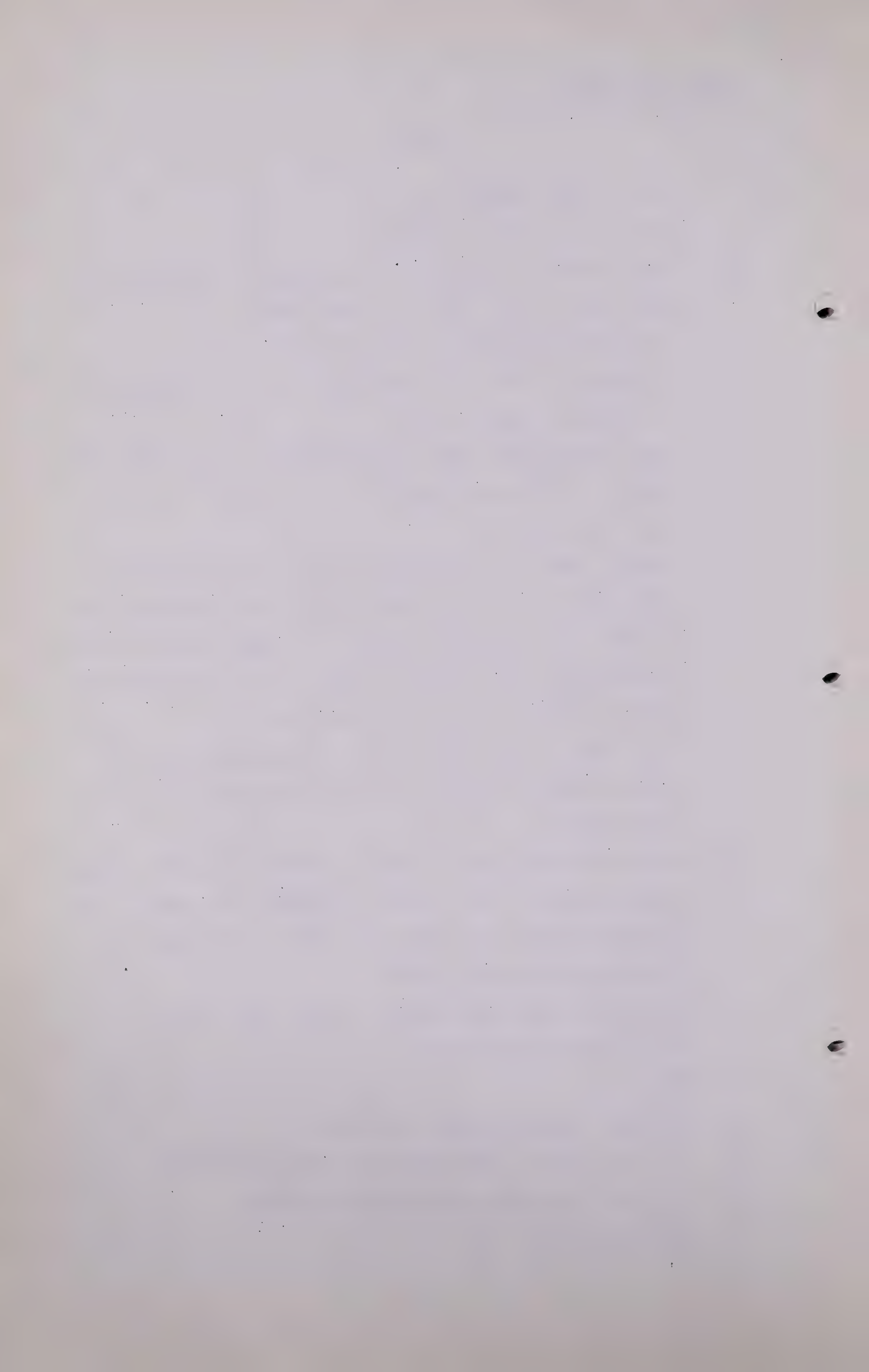
A No.

Q You have one well there, have you?

A Not in Acheson. There are 20 or 30 wells there.

Q Are they indicated on the map following?

A Yes, they are.



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Q Will you take now the fields that the Board dealt with in its report? I would like to ask you whether all those fields are included in the list that you have given on pages 2, 3, 4 and 5 of your Exhibit 4? There may be others but . . .

A I believe all of them are included. I have not checked one against the other but I believe they are all included.

Q You have added certain fields or wells to that list?

A Yes.

Q And from your Exhibit 4 you have reduced the production, possible production below the figures adopted by the Board. I refer you to Medicine Hat, Turner Valley, Joseph Lake, to mention three of them. I think in Medicine Hat you give 277 against the Board's 320; in Turner Valley you give 251 against the Board's 300 and in Joseph Lake you give 6.2 against the Board's 15. Have you a copy of the Board's report before you?

A Yes, I have.

Q That is right, is it not?

A Yes.

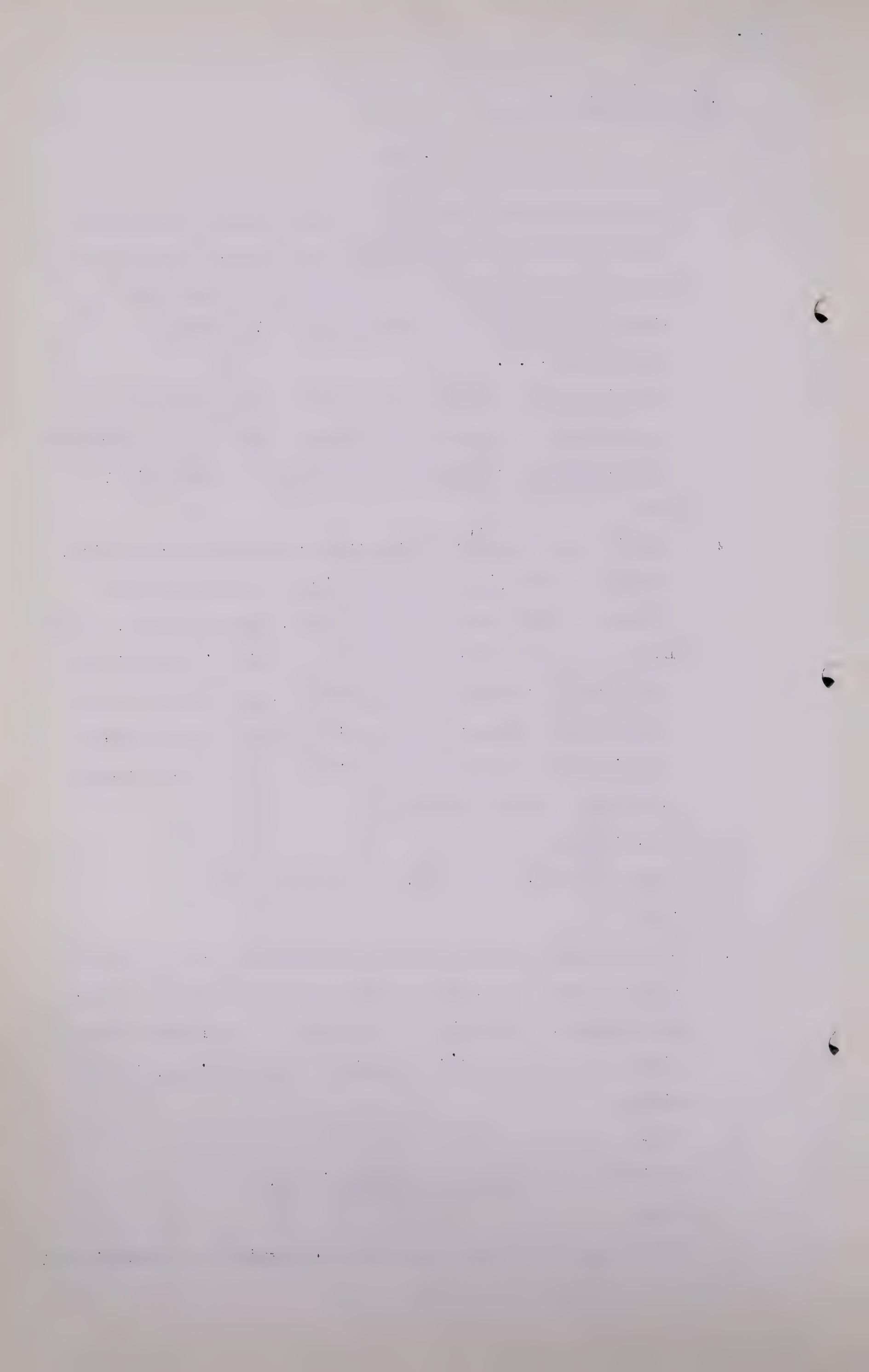
Q And then with respect to other fields you have given us figures which are substantially above the Board's figures. For example, I am going to mention 5. For Legal you have given us a figure of 74.3 against the Board's 4, is that right?

A Yes.

Q Morinville 223 against the Board's 68?

A Yes.

Q In Redwater you have given us 195.3 against the Board's 50?



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A Yes.

Q And in Viking Kinsella you have given us 1013 against the Board's 582?

A Yes.

Q And in the Princess Patricia you have given us 335.2 against the Board's 101. I want you to look at that carefully and tell me whether these are comparable figures. I gather that they are.

A Comparable in what way?

Q I mean they are referring to the same thing?

A Yes.

Q All right.

A Except that in Morinville, for example, three wells have been drilled since the Board . . .

Q I will come to that. I want to be clear about this Princess Patricia matter. You see the Board on page 17 has Princess Patricia, the third item down, and the quantities given are 38 and 58 and 5 from the three different sands, a total of 101. You, in J-30, deal with Princess and Patricia separately, I think. Yes, you do, away down about halfway down the page, Princess and Patricia and you have three sands. The total I have arrived at is out in the last column as 335.2. Those are the same areas aren't they?

A Yes.

Q Then in your Exhibit 4 you have included some fields with respect to which evidence was before the Board but which the Board in its report ignored. Is that right?

A Yes, the Board did not include in their report, that is

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right.

Q Yes, that is right. Quite a few of those?

A Yes. The reason for that is that I agree with the American Gas Association who say that a well that discovers gas proves gas reserves. If there is a gas well there is gas there.

Q You do not agree with the American Gas Association when they say that in their view fields of 20 billions or less are not economic to gather?

A This is a reserve report, not an economic report.

Q You agree with them in one case, do you agree with them in the other?

A In the case about the 20 billion?

Q Yes?

A I do not know anything about that.

Q I see. Do I take it that you say with regard to this Exhibit 4 that all your quantities of gas of 5 billion and below may or may not be economically gathered?

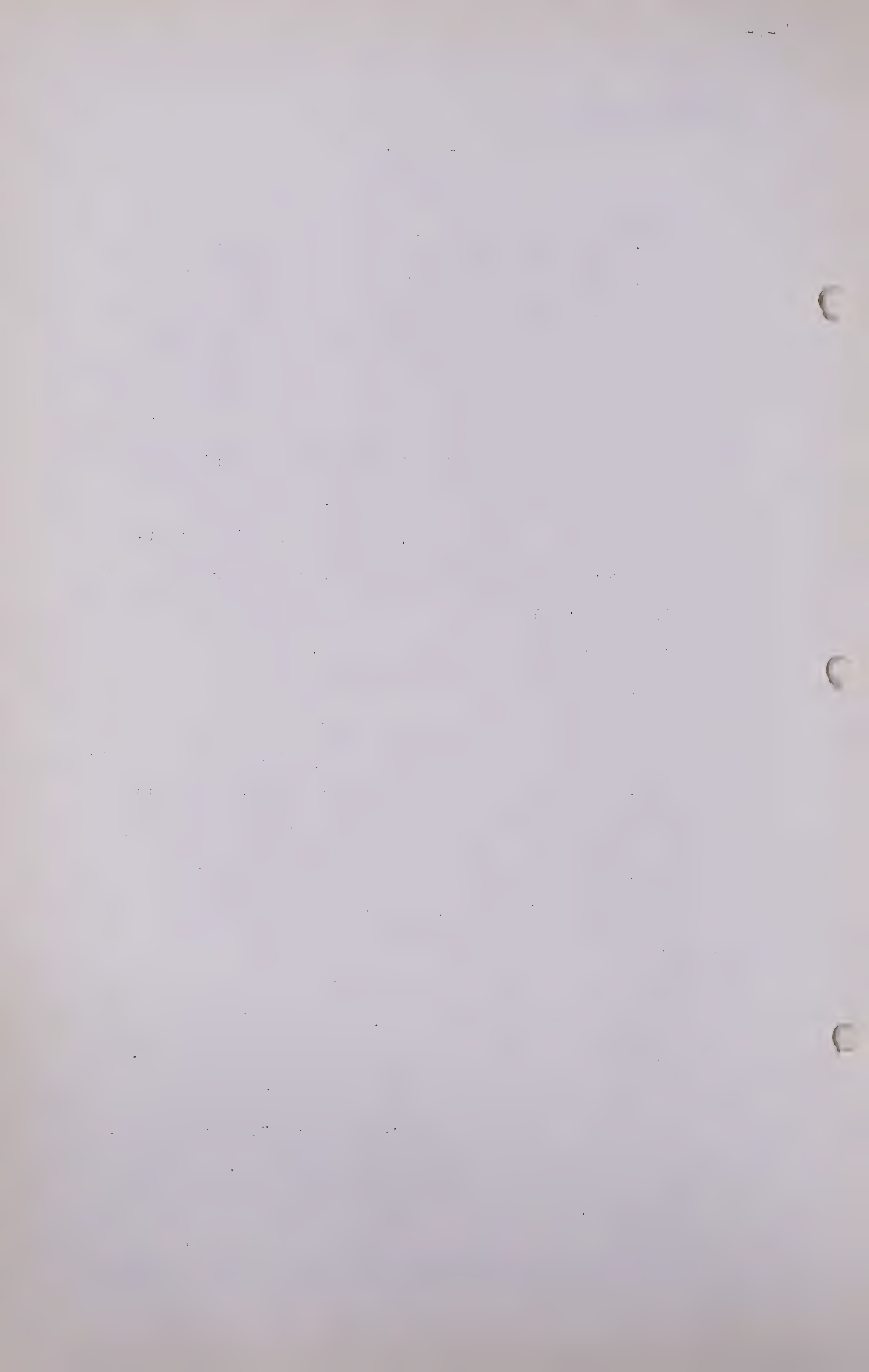
A Yes, the smaller the reserve the less chance of their being economically gathered.

Q I see.

A But we must bear in mind that as a region develops around a small gas reserve, gas pipe lines might move right through the field and it would be gathered.

Q So that when you are using the word "marketable" in this plate of yours, or "recoverable", recoverable, that has nothing at all to do with marketing. Am I right in that?

A It has nothing to do with accessibility, no. It has



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nothing to do with economics.

Q If the Board is going to decide how much gas there is available for the market today, it has got to look at the geography of these areas and decide whether or not it is economic to build a pipe line to gather that gas?

A Yes.

Q Your evidence has nothing to do with that?

A No.

Q Did it have anything to do with it when you described these reserves in J-30 as marketable?

A No, it did not. I defined that as being marketable at the edge of the pool. If a pipe line came to the edge of the pool that amount of gas would be marketable.

Q We have got to get somebody else to tell us whether or not these quantities of gas of yours in Exhibit 4 are presently available for the market?

A Yes. A submission on their location and how that affects the economic must be presented.

Q We will have to find that out from somebody else. In addition to what I have said you have included in your Exhibit 4 some new fields altogether with respect to which there was no evidence before the Board?

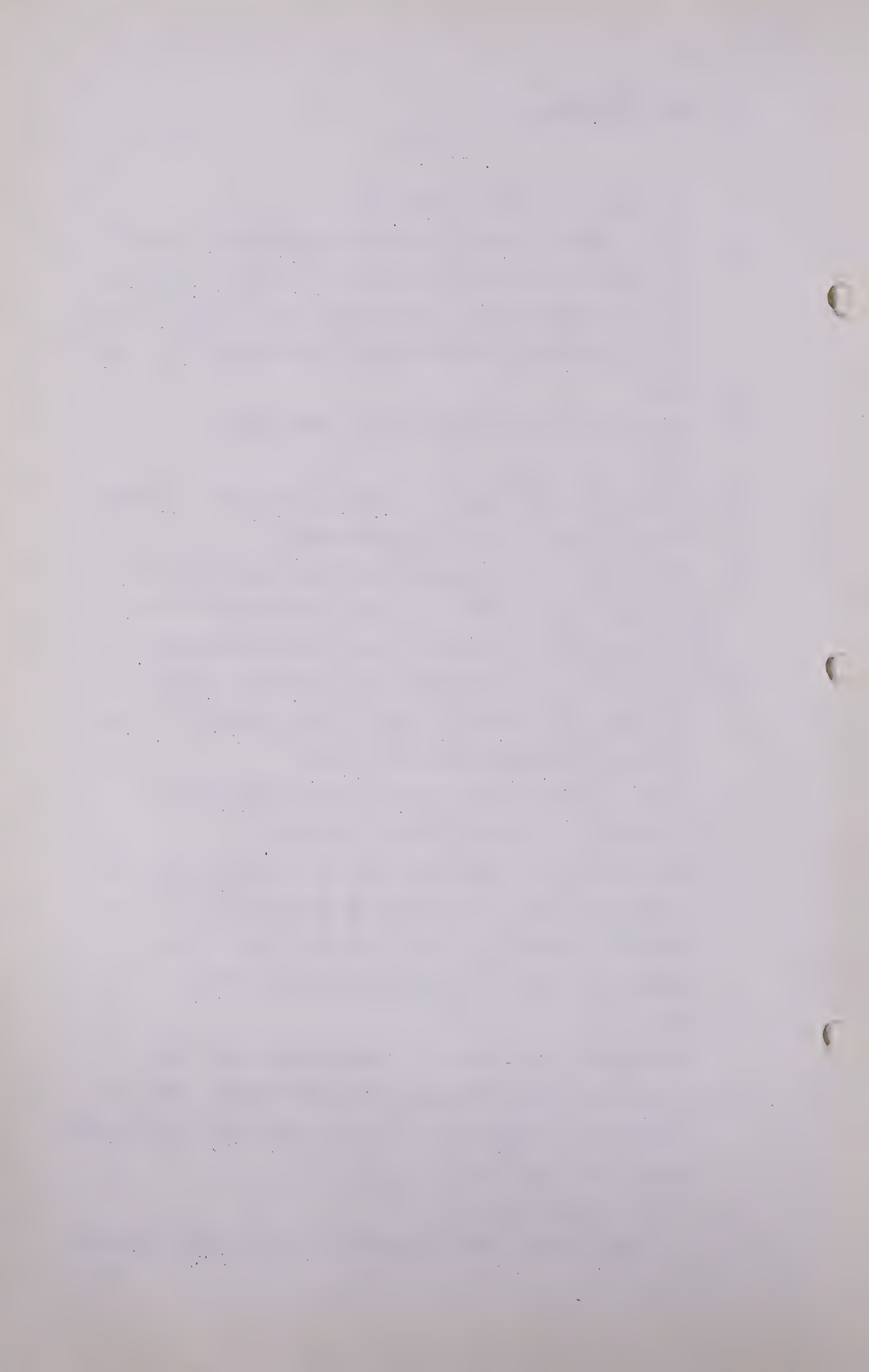
A Yes.

Q Any particular reason for reducing Medicine Hat?

A I did not reduce Medicine Hat. My estimate came out before the Board's and I did not change it. And I would agree with the Board.

Q What is your reason . . .

A To this extent, that my figures are not always going to



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jibe with another set of figures. They are not always going to be the same as . . .

Q You say in Turner Valley today there is 251 and the Board said on the 1st of January of this year there were 300. How do you account for that difference, if you can account for it?

A I took 251, which was the published figure, and I have not made a study, I have not revised that figure. There is a great deal of work involved in calculating gas reserves in Turner Valley. I did not make an independent reserve calculation.

Q What I suggest to you is that the reasonable approach to this thing would have been to adopt the Board's figure as to quantity in Turner Valley as of the 1st of January of this year and then apply your judgment to what has happened since.

MR. McDONALD: Does the Gas Company adopt that figure?

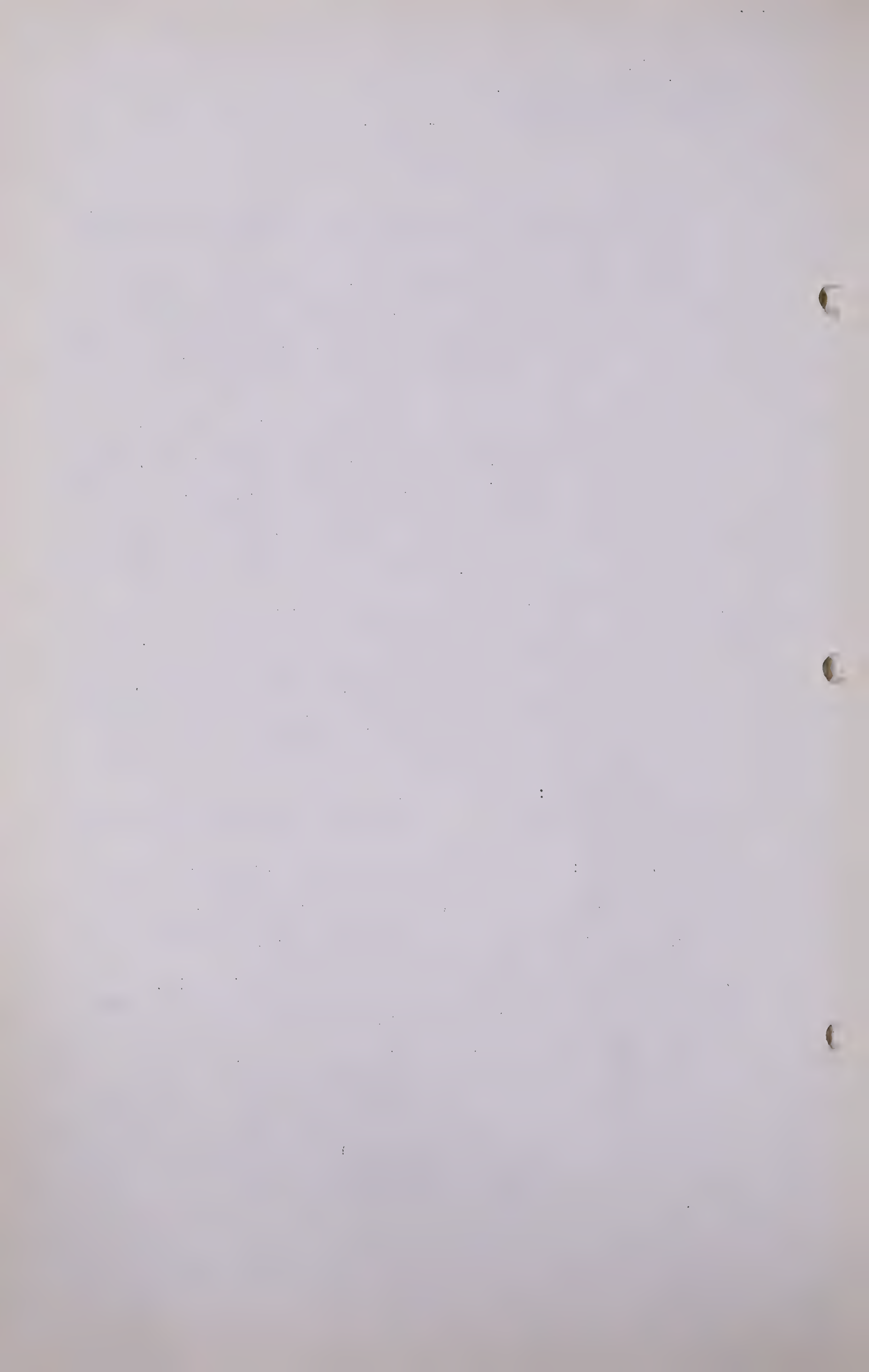
Q MR. STEER: Is not that right, Dr. Nauss?

A No, I do not think so. That is not the approach. I made an independent reserve calculation.

Q Joseph Lake you give 6.2 and the Board gives 15. Have you any explanation of that?

A I think it is a different interpretation.

(Go to page 114.)



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Q Then let us go to cases where your figures are above the figures of the Board, and I refer to the five instances where the differences are substantial. Now, I would like to ask you, Dr. Nauss, if in your opinion there have been developments since the first of January this year that will account for these differences between 4 and 74 in Legal, 68 and 223 in Morinville, 50 and 195 in Redwater, 182 and 1013 in Viking-Kinsella, and 101 and 33.2 in Princess-Patricia? Have there been developments this year that would account for those differences?

A Not entirely, no.

Q Have there been any?

A Oh, yes.

Q What?

A Mainly the drilling of three wells in the Morinville pool.

Q I want now to go over those fields with you in detail. How many wells in Legal?

A Three.

Q How many wells in the Legal area have been drilled through the Viking sand?

A In the Legal area? What do you mean by the Legal area?

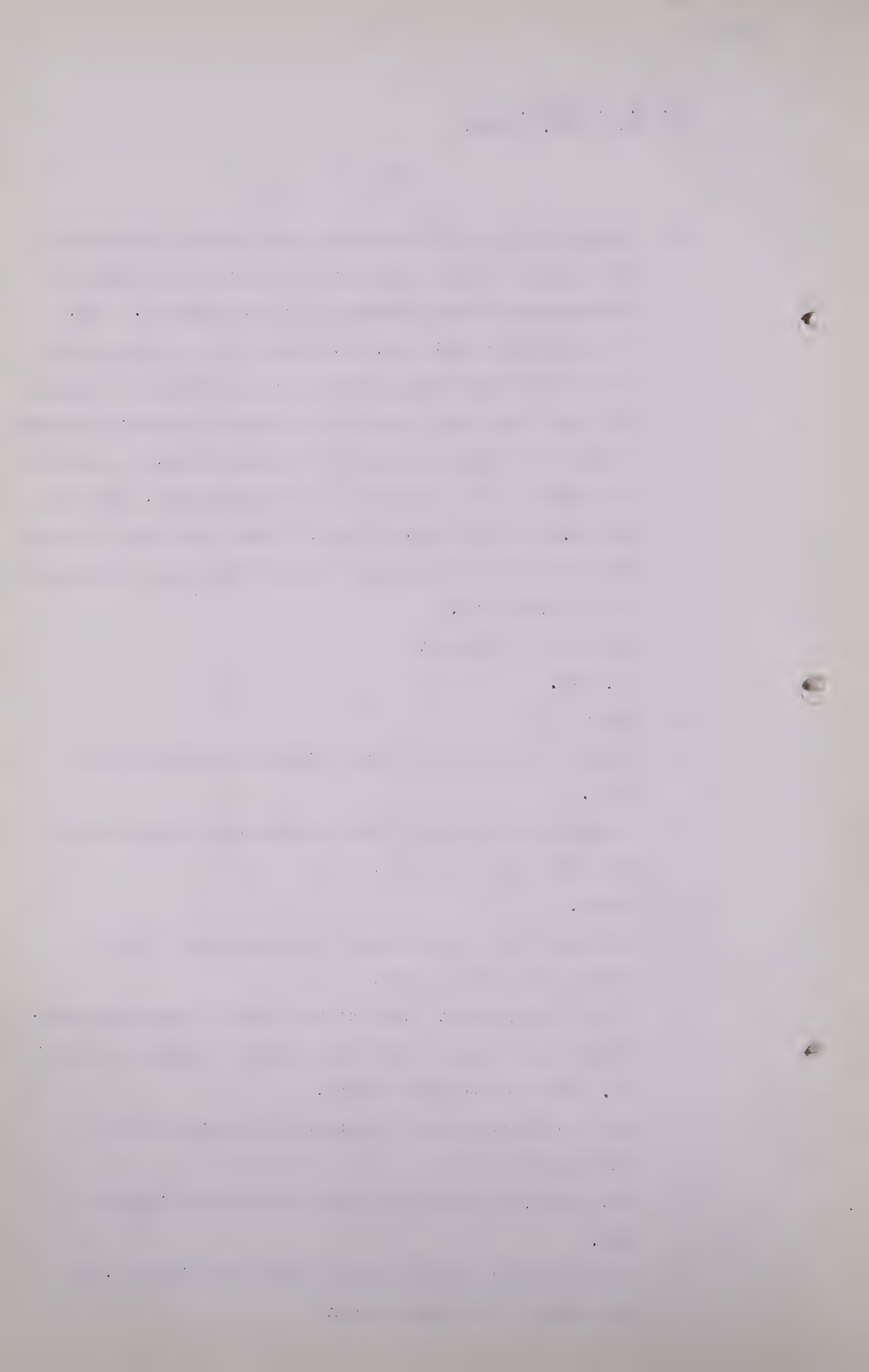
Q I mean the area that the Board refers to and you refer to. Are they the same thing?

A Are you talking about the productive area or the surrounding area?

Q Dr. Nauss, in your J-30 there is the word "Legal"?

A Yes.

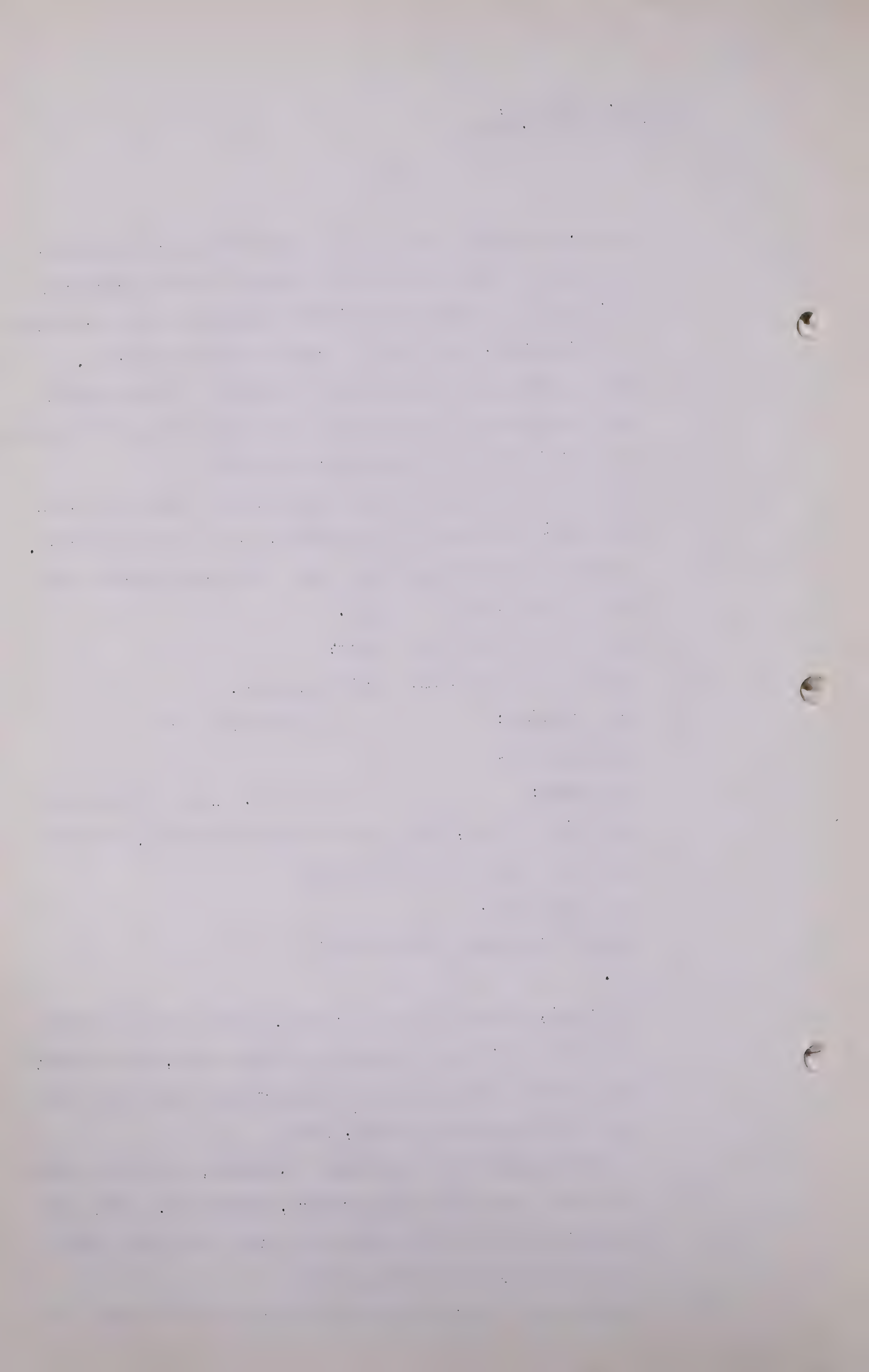
Q In the Board's report there is the word "Legal". Do they refer to the same area?



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- A Well, they refer only to the productive area in those reports but additional wells outside of the productive area give information on it that enables you to calculate the reserves, helps you to calculate the reserves.
- Q Let us find out if we can get together. Is the Legal area referred to in your J-30 the same thing as the Legal area referred to in the Board's Report?
- A There is a possibility that they do not take into consideration the well to the south. As a matter of fact, I am quite sure they do not take into consideration the well to the south of Legal.
- Q What are you looking at now?
- A I am looking at a map behind page 28.
- Q MR. McDONALD: Of Exhibit 4?
- A Of Exhibit 4.
- Q MR. STEER: I see. And what you are referring to now, what you are suggesting now, is that the Board dealt with two wells?
- A With two wells.
- Q And you have dealt with three?
- A Yes.
- Q All right, we will take your area, and there have been three wells drilled through the Viking sand, have there?
- A Well, there have been more than that but within the area there have been three wells, yes.
- Q We are talking about the area, Dr. Nauss, that you refer to on this map and in your report, Exhibit 4. Now, are we clear that in that area there have been three wells drilled through the Viking sand?
- A You also get information on the thickness of sands out-



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side of the area, outside of the productive area.

Q Yes, but you are not responsive to my question, Dr. Nauss. I want you to talk about the area that you have outlined on this map to which you have referred, and what you have referred me to is a circle below the white dot in the centre and then a line running up and around that, is that right?

A Yes.

Q On your map, and in that area which you describe as the Legal area there have been three wells drilled through the Viking sand?

A Within the area, yes.

Q Within the area. And how far apart are they?

A The farthest distance is three miles.

Q Now, am I right in thinking that those two block dots above there represent Imperial Legal 1 and 2?

A Yes.

Q And that the white dot down in the centre of the circle represents Imperial Waybrook No. 1, is that right?

A Yes.

Q Now then, how far is it between the two upper wells?

A It is approximately 1 mile.

Q And how far is it from those two upper wells down to Imperial Waybrook?

A Three miles.

Q Yes. What would you expect the sand thickness to be in a well drilled half way between Imperial Waybrook and those two upper wells?

A I would wait until the well was drilled to find out.

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Q What is the sand thickness in Imperial Legal 1 and 2?

A That information was given in the previous report.

I do not have it here.

MR. McDONALD: What is that question
again?

THE WITNESS: The thickness of the sand
in 1 and 2.

Q MR. STEER: Which previous report?

A The report at the previous Hearing.

MR. McDONALD: That would be Exhibit 3
in the Westcoast Transmission.

Q MR. STEER: I see. What I am trying
to get at, Dr. Nauss, is on page 23 of your Exhibit 4
where you get that average thickness of 15 feet, you
can not tell me, Dr. Nauss, what you would expect the
thickness of the sand to be half way between those two
Imperial Legal wells and the Waybrook well? You can
not give me an opinion on that?

A I can not give you an opinion, no.

Q Would you expect it to be the same thickness as the
Imperial Legal wells and the Waybrook well?

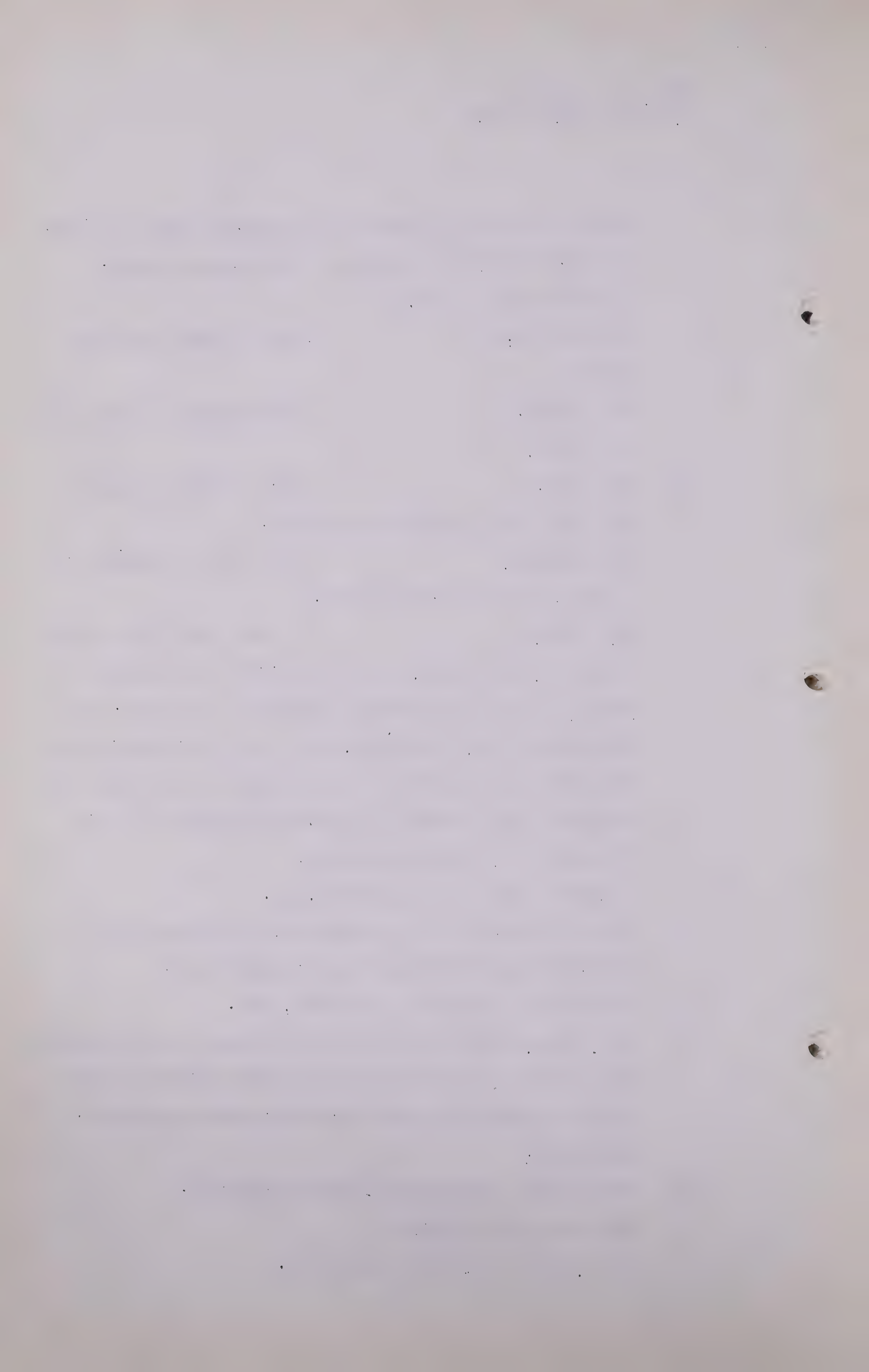
A It would be something like that, yes.

Q Yes. Now, suppose that I tell you that I am instructed -
first of all, you would expect a well drilled a mile
north of Legal #2 to have about the same thickness,
would you?

A Not of Basal Cretaceous, not necessarily.

Q What about the Viking?

A Well, in the Viking it might be.



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Q Suppose I tell you I am instructed that one of those wells has a thickness of 2 feet and the other has a thickness of not more than 5 feet?

A Except it is outside the area.

Q What effect would it have on your judgment?

A Well, you are talking about what I understand is on the edge of that area.

Q One of them is midway between the two Imperial Legal wells and the Waybrook well and the thickness of that well is 2 feet - the thickness of the sand in that well is $2\frac{1}{2}$ feet.

MR. C.E. SMITH: Would you mind letting us know the name of that?

MR. STEER: It is the Northwest Utilities well of which we will give evidence later.

THE WITNESS: Could we have the location of that well?

MR. STEER: Northwest Utilities Legal 1.

A My understanding is that the location of that well is on the edge of that area.

Q Now, will you tell me, Dr. Nauss, on what evidence you base -

MR. McDONALD: Just a moment, Mr. Chairman. Could we have the location of that well?

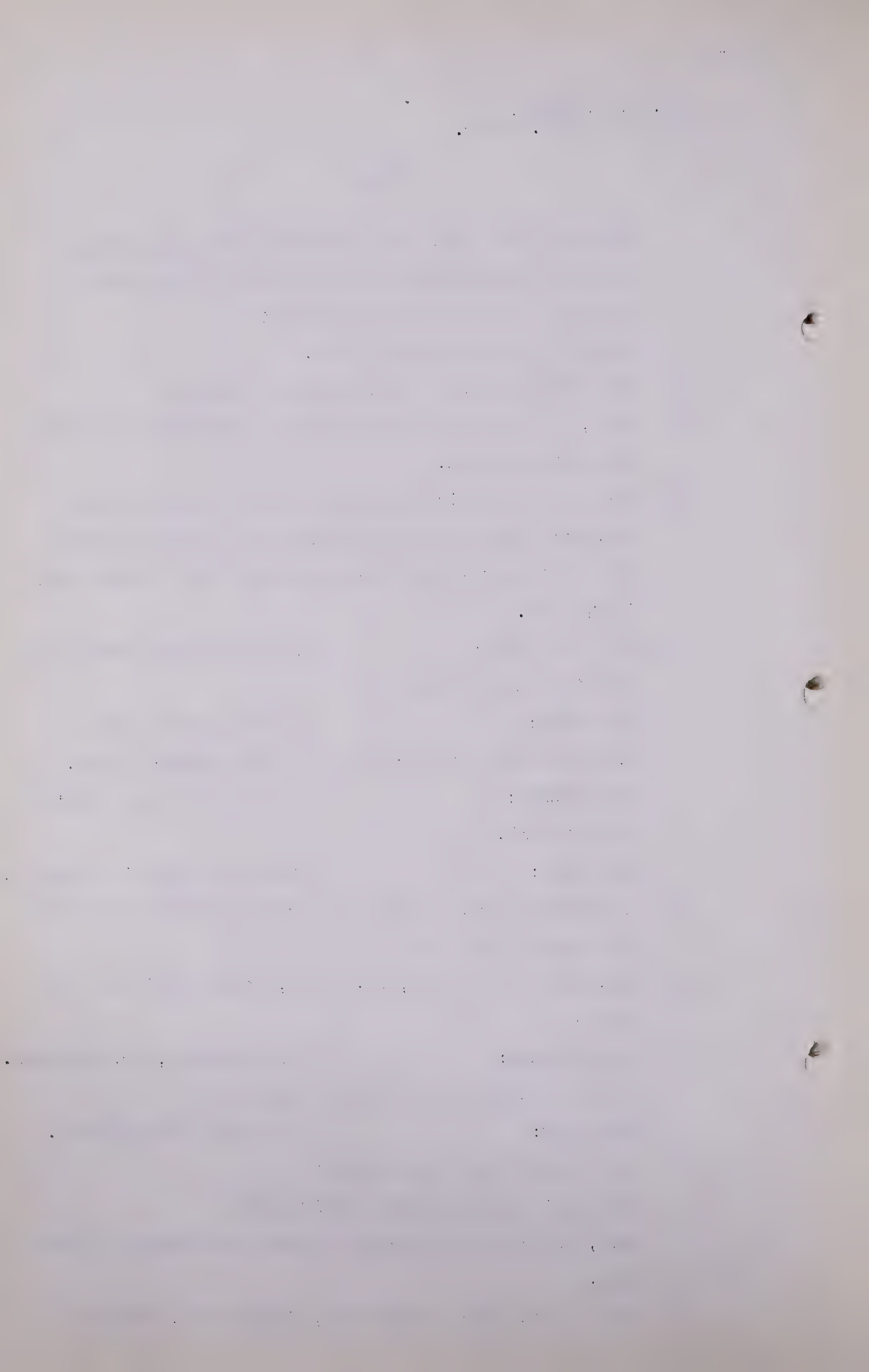
MR. STEER: The centre of Section 4.

A What is the legal subdivision?

Q We haven't got the legal subdivision.

A Well, the centre of Section 4 would be outside of that area.

Q It is on the edge of the area, Township 58, Range 24,



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West of the 4th.

A I looked up the location before coming to the Hearing.

Q You say that sand thicknesses there on the easterly edge and on the northerly edge have no influence on your judgment as to the thickness within the area?

A Since it is outside of the area.

Q That is the best answer you can give, is it? I asked you whether if we had sand thicknesses of 2 feet in one case and 5 feet at the outside in the other at these locations, one on the easterly edge and one on the northerly edge of the area, that would affect your judgment as to the sand thickness?

A Well, you see, here is the situation, that is a stratigraphic trap and its existence is probably due to the fact that the sand pinches out. The fact that your well shows evidence of it pinching out merely confirms the existence of the pool, gives you more reason for its existence.

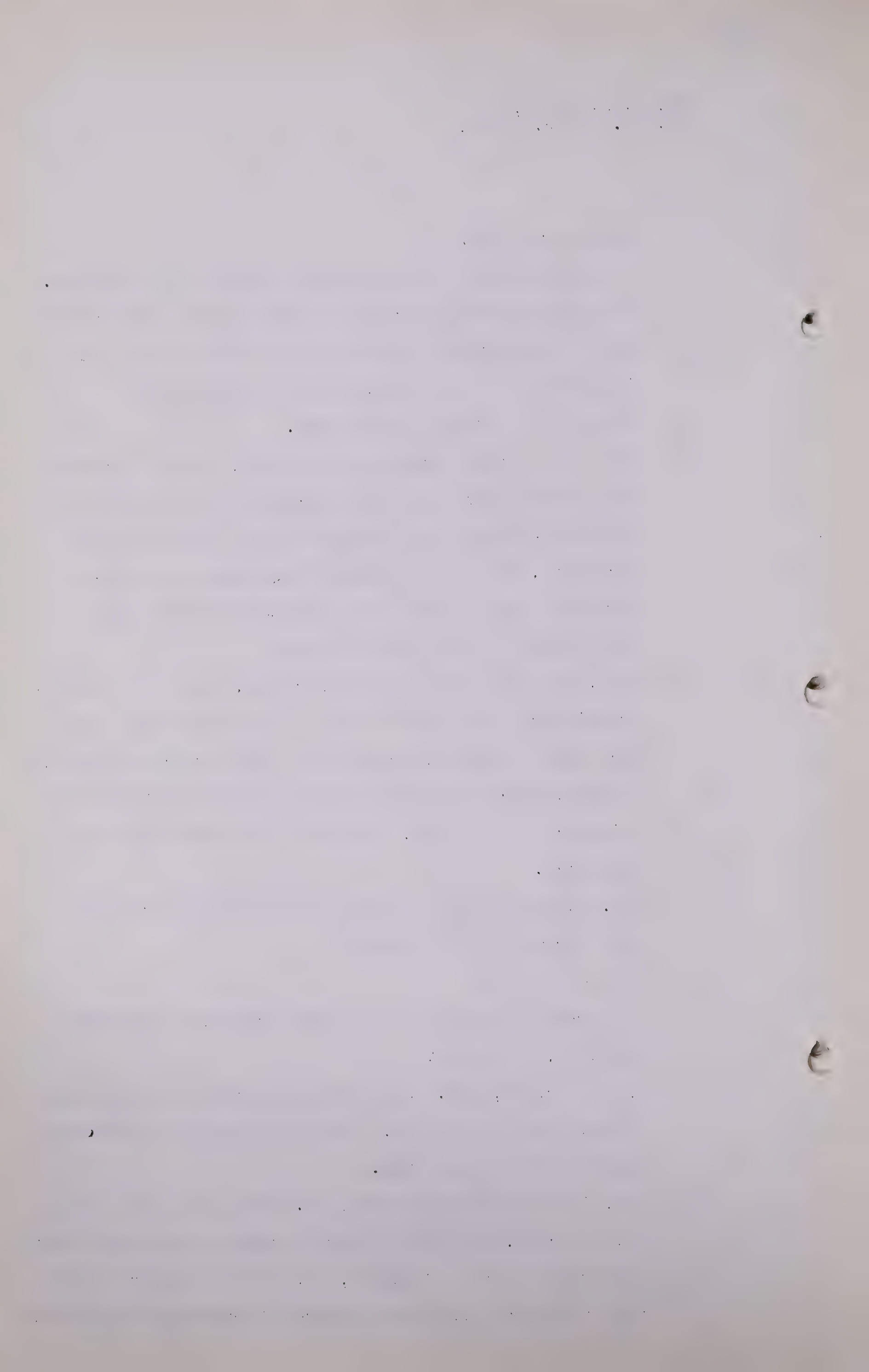
Q Yes. Will you tell us then how you compute in Legal your acreage of 7700 acres?

A By - -

Q - - drawing those lines you have drawn and computing the area, I suppose?

A That is right, yes. We could have drawn an isopach map of that particular area. There will soon be sufficient wells to make such a map.

Q Now, in the Morinville area, Dr. Nauss, you still have 11,960 acres, and in the Board's report they credit that pool with an area of only 4,000, and is it your opinion that there are 11,960 acres there of proven gas reserves?



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A Well, I think that the additional gas wells that have been drilled there will certainly have extended the area. It would be very difficult to get an area as small as 4,000 acres there now.

Q How many wells have been drilled in this Morinville area?

A There have been five gas wells within the area, five successful gas wells, and an additional well, Ajax No.3, on the eastern edge.

Q Well, there is an Imperial Morinville No. 1 within the area, isn't there?

A Imperial Morinville No. 1 and No. 2 are within the area, Ajax No. 1 and 2 and the Cardiff Giant No. 1.

Q And Ajax No. 3 is a sixth well drilled outside of the area, is it?

A Yes, Ajax No. 3 is a sixth well on the eastern edge.

Q Yes. Now, would this be right, that Imperial Morinville No. 1 has a production of 2.5 million feet per day?

A They are not producing a well.

Q Do your tests indicate that it would have a production, or do the tests indicate it would have a production of 2.5 million feet per day?

A I do not know about that figure.

Q Does the evidence in Exhibit 4 with respect to this well indicate a production of 2.5 million feet per day?

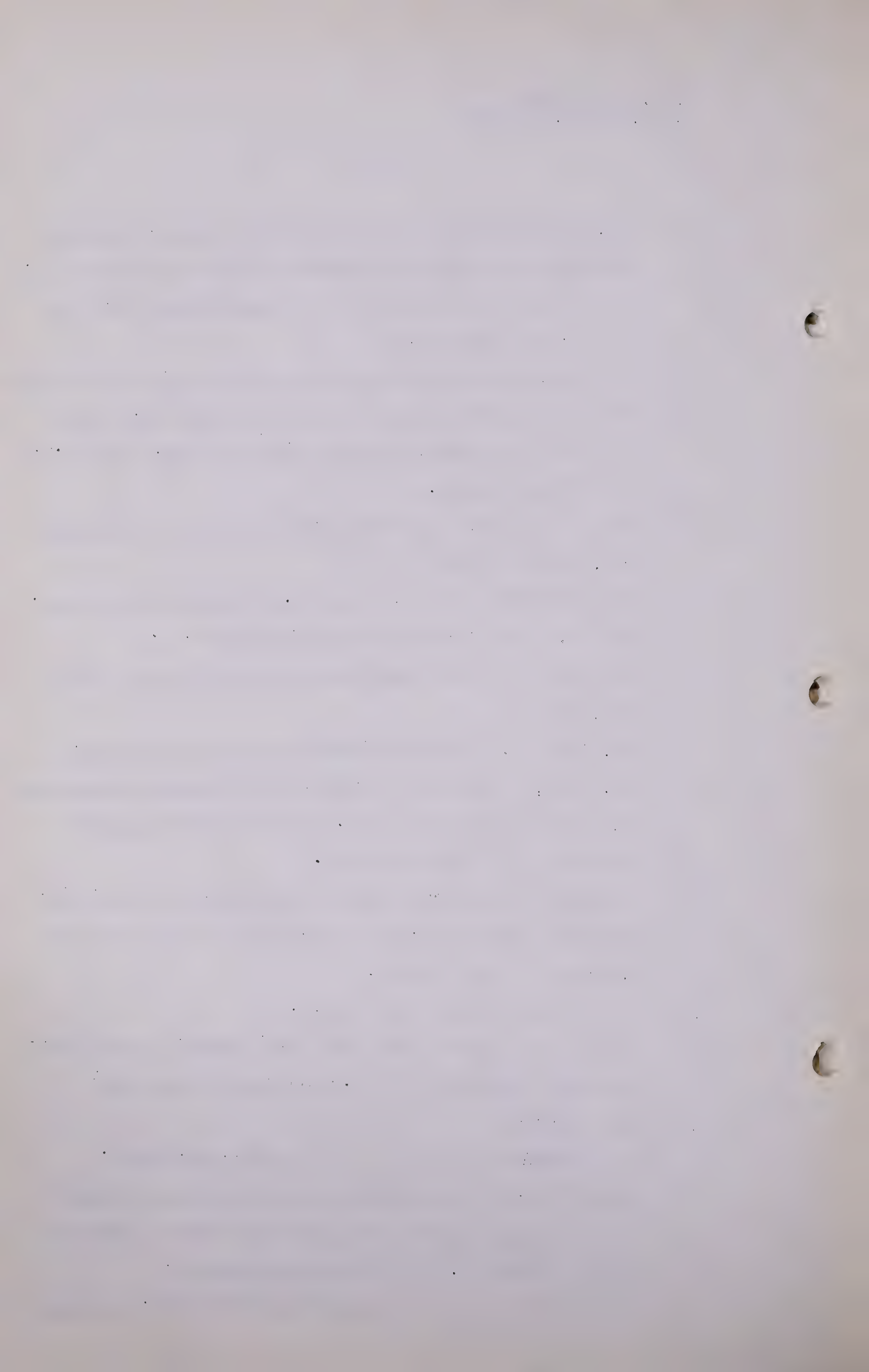
A The evidence?

MR. McDONALD:

Page 29, Dr. Nauss.

A The evidence at page 29 is incomplete because we gave the drill stem tests on Imperial Morinville 1 and 2 and Cardiff Giant No. 1 in our previous report.

Q I am asking you about Imperial Morinville No. 1 on page



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29 where you say, I take it, that the most up-to-date information is that the gas flow of 2500 Mcf. per day was produced from this well. Is that right?

A On a drill stem test.

Q That is all I am talking about. And am I right in saying that your evidence now is that Imperial Morinville No. 2 has a production of 5.5 million feet per day?

A No. There were numerous drill stem tests that had yields ranging from 1,250,000 to 5,500,000. There were half a dozen drill stem tests.

Q What would you say then is the productive capacity of that well?

A We have not given the productive capacity.

Q You can not give it to us now?

A Not on the basis of the information we have right now, no.

Q What would be required in order to give me the productive capacity of Imperial Morinville No. 2 well?

A They would have to gun-perforate the casing and take a test.

Q Which has not been done?

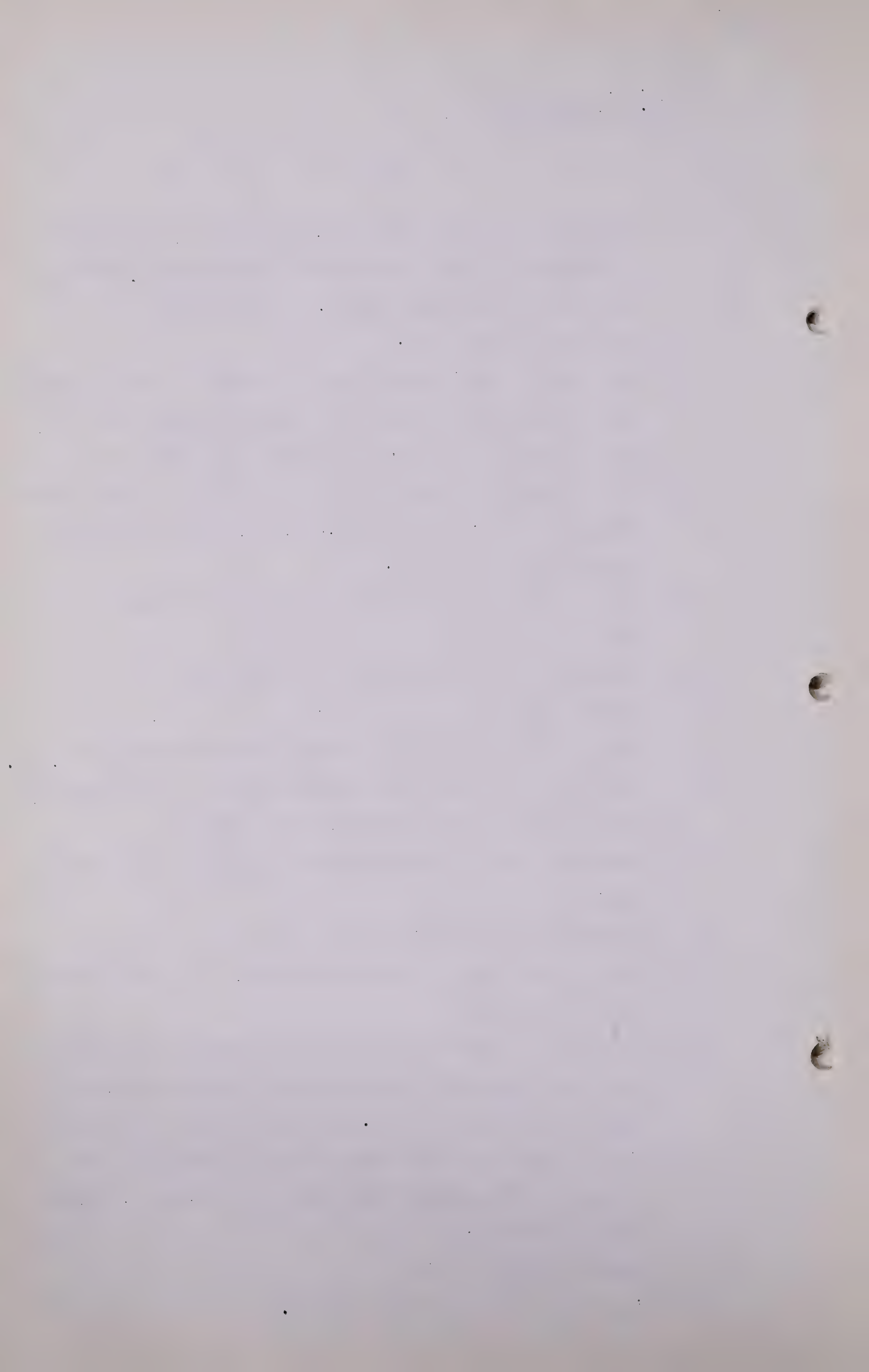
A I do not believe it has been done yet. In their program it will be done.

Q Would it be true to say that on the basis of the knowledge that you have at the present time the productive capacity of that well is 5.5 million cubic feet per day?

A No, I think that on the basis of the information that we have at the present time that the productive capacity should be greater.

Q How much should it be?

A Oh, I can not answer that question.



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Q Would it be true to say that Imperial Morinville No. 3 has a productive capacity of 4 million cubic feet per day?

A No, that would not be correct.

Q What would be correct? You do not know?

A The drill stem tests do not indicate. There is no formula which you can apply to the results of drill stem tests to determine what the productive capacity will be when the well is completed.

Q Now, this is another case where we have got incomplete evidence, is that right?

A You can always get more evidence by doing more work, yes.

Q Would it be true to say that the Cardiff Giant has a productive capacity of 3.2 million cubic feet a day?

A No.

Q You are not prepared to tell us what it would be?

A No, because I don't know.

Q And you say the likelihood is that the evidence does not exist from which we could get this information, is that right?

A Well, the Ajax people have a program of developing that area. They are going to go into a number of those wells and take production tests. Imperial Morinville No. 1 and No. 2 were not completed as wells, they did not set casing in them and consequently in order to go into the wells again you would have to drill out the cement plugs and set casing, gun-perforate it and make tests. Now, that work has not yet been done.

Q Look at Imperial Waybrook on page 23 for a moment, will you? Is there enough information for you to tell us what the productive capacity of that well is?

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A This drill stem test information. The fact the Imperial Waybrook produced 7 million cubic feet per day indicates it will probably produce more when properly completed.

Q Yes?

A Which is pretty good evidence.

Q And how much more you would not be prepared to say?

A No, I certainly could not say how much more.

Q Or whether there is a possibility of producing less?

A There is no reason in the world once having got 7 million a day on a drill stem test you could not get 7 million a day again. All you would have to do is duplicate that test and you would get it.

Q Duplicate the test?

A Duplicate the conditions of the test and you will have your 7 million a day.

Q I am talking about the productive capacity of the well over a period of time. Is it possible we would get less than 7 million a day supposing we operated it over six months?

A Not likely.

Q Is it possible?

A With a reserve of 217 billion and a drill stem test of 7 million cubic feet per day, the likelihood is that the open flow of that well would not drop below 7 million a day in six months.

Q So that your answer is that it is not possible?

A I did not say it is not possible.

Q In your opinion?

A It is not likely.

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Q I see. That does not answer my question as to whether or not it was possible.

A Some rare and peculiar circumstance could cause it to be possible.

Q Now you have got Redwater as 195 and the Board gives it 50. Is the explanation of that your proposition that you are dealing only with reserves of gas and having no regard whatever to their marketability?

A I think that is mainly a matter of gathering because the amount of gas present, you take the oil reserves of Redwater and multiply it by 180 cubic feet per barrel of gas and you would get considerably more than that figure.

Q More than what figure?

A More than 50 billion.

Q More than 50 billion, yes.

A As a matter of fact, it is up near 300 billion.

Q If you set your mind to considering what amount of gas was marketable out of Redwater, Dr. Nauss, would you consider first of all that the gas had to be scrubbed?

A Yes, the gas would have to be.

Q And would you consider that it is an oil field with a low gas-oil ratio?

A Yes.

Q You would consider that?

A Yes.

Q And would you consider the cost of building pipe lines to gather the comparatively small amounts of gas that are produced with the oil?

A Yes.

Q And would you consider the fact that it is a pumping

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field?

A Yes, I would.

Q That is, I suppose, the same thing as saying it has a low gas-oil ratio, is it right?

A The low gas-oil ratio is one of the things, one of the factors that causes this to be a pumping field. The main factor is pressure.

Q I am suggesting to you it is those factors that probably led the Board to say that there is 50 billion cubic feet of marketable gas there rather than 195, as you say?

A Of course, if you are going to go into the economics of gathering that gas, is it marketable at a price? The Texas Conservation Board states that there is practically no waste in the oil fields of Texas. Well, if that is the case, then maybe we could arrange it so there is no waste in such an oil field here. It is a matter of price.

Q Yes, I suppose that would be true.

A If Alberta urgently needed gas that gas would be collected.

Q Now, I will ask you a few question on the Viking-Kinsella. In your plate you give for Viking-Kinsella 336,000 odd acres, don't you, 366,080 acres?

A Yes.

Q And Mr. Davis, when he was giving evidence before the Joint Hearing, assigned an acreage to the Viking-Kinsella field of 245,202 acres. Do you remember that?

A I do not know.

Q Or perhaps you will take it from me that that is what he said. Now, does your acreage contain marginal area? Would you be prepared to say that it contained the

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marginal area surrounding the main productive area in the Viking-Kinsella field?

A Yes, it includes marginal area around the main productive area.

Q Now, how did you define that marginal area? What did you go to for your evidence to show that there were 366,000 acres in the field?

A Well, I took many wells. Even though they may not have had high open flows I included them.

Q Yes?

A Because there is one principle, even though a gas well may not be economic itself the gas over a period of years will drain from an area where you can not drill economic gas wells to the wells that are already producing in the economic part of the field.

Q I am going to read you part of what Mr. Davis said, Dr. Nauss, and I am reading at page 8 of Exhibit J-7 at the Joint Hearing:

"The areal extent of the Viking-Kinsella gas field is estimated to embrace some 245,202 acres. This is the area within which it is judged that commercial gas wells can be drilled."

I take it you quarrel with that and say that 366,000 acres is the area within which gas wells can be drilled commercially?

A I just stated that in addition to the area in which you can drill commercial gas wells there is the surrounding area in which you can not drill commercial gas wells that contain gas which will drain into the commercial area.

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Q To get your result has that surrounding marginal area got to be 15 feet thick, the sand?

A I would have to make a pretty quick calculation.

Q Well, let us look at your tables and see if that is not what you have done.

A No, it does not have to be 15 feet thick.

Q Well, haven't you got acre feet here of 5,491,200?

A Yes.

Q And isn't that 15 times 366,080?

A Yes.

(Go to page 128)

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Q Yes?

A That does not mean to say that that is the area where we are having to go to a thickness of 15 feet, but that is the average thickness over the entire field.

Q I see?

A Those parts that are thicker make up for the parts that are thinner.

Q Then, Dr. Nauss, we would have to have a gas sand in the Viking-Kinsella field, I suppose, 30 feet thick to justify your multiplication of 366,000 by 15?

A You would have to have a large area where the thickness is more than 15 feet.

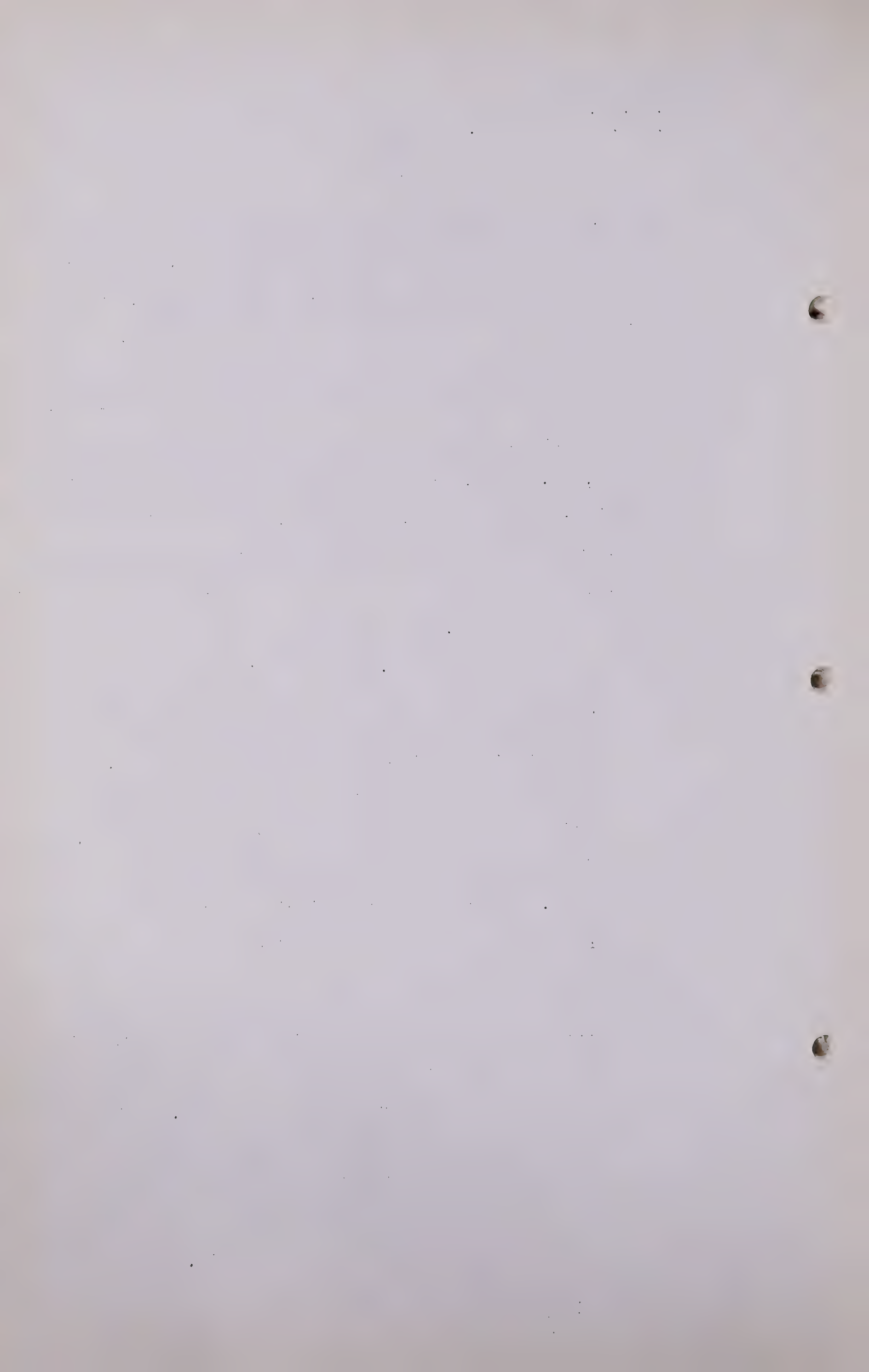
Q Yes. Here is what Mr. Davis says:

"The Viking sand is present over a substantially larger area surrounding the commercial area, but because of poor sand development wells drilled in this outside area have had a modest, less than 2 million cubic feet per day, open flow. Evidence available indicates that the probable effect of pay sand," -

I am sorry -

"...Evidence available indicates that the probable effective pay sand thickness in this marginal area is of the order of 2 feet or less. This marginal area does contain gas but in such a modest amount that it will probably not be developed and the recovery will be by drainage into the commercial part of the field."

I take it you agree with that?



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A Yes.

Q I take it that you agree with Mr. Davis's estimate that the commercial part of the field is 245,202 acres?

A I have not made - I have not drawn that particular area on the map so that I cannot say. I do not know.

Q Anything that you did in the way of investigation in this field was paper work, having in mind the results of reports on wells to which you had access?

A No, I examined, I ultimately examined some of the cores of the wells.

Q Now, Mr. Davis says,-

"The effective pay thickness is estimated at 7.8 feet for the 245,202 acres of commercial gas lands."

And you say that it ought to be 15 feet over 366,000 acres?

A The reason for the difference is that he is eliminating those sands that have poor drillstem tests, and they are taken into consideration by me, that part of the sand above and below the commercial productive sand, and that sand is poorer, the sand is quite fine-grained. There is sand above and below the better part of the sand which also contains gas in which you got poor drillstem tests, but over a long period of years that gas will drain down into the carrier bed.

Q Yes, but you are telling me, as against Mr. Davis's 245,000 times 7.8, you want the Board to adopt 366,000 odd multiplied by 15, that is right?

A Yes.

Q And the reason you give is that you consider the sources

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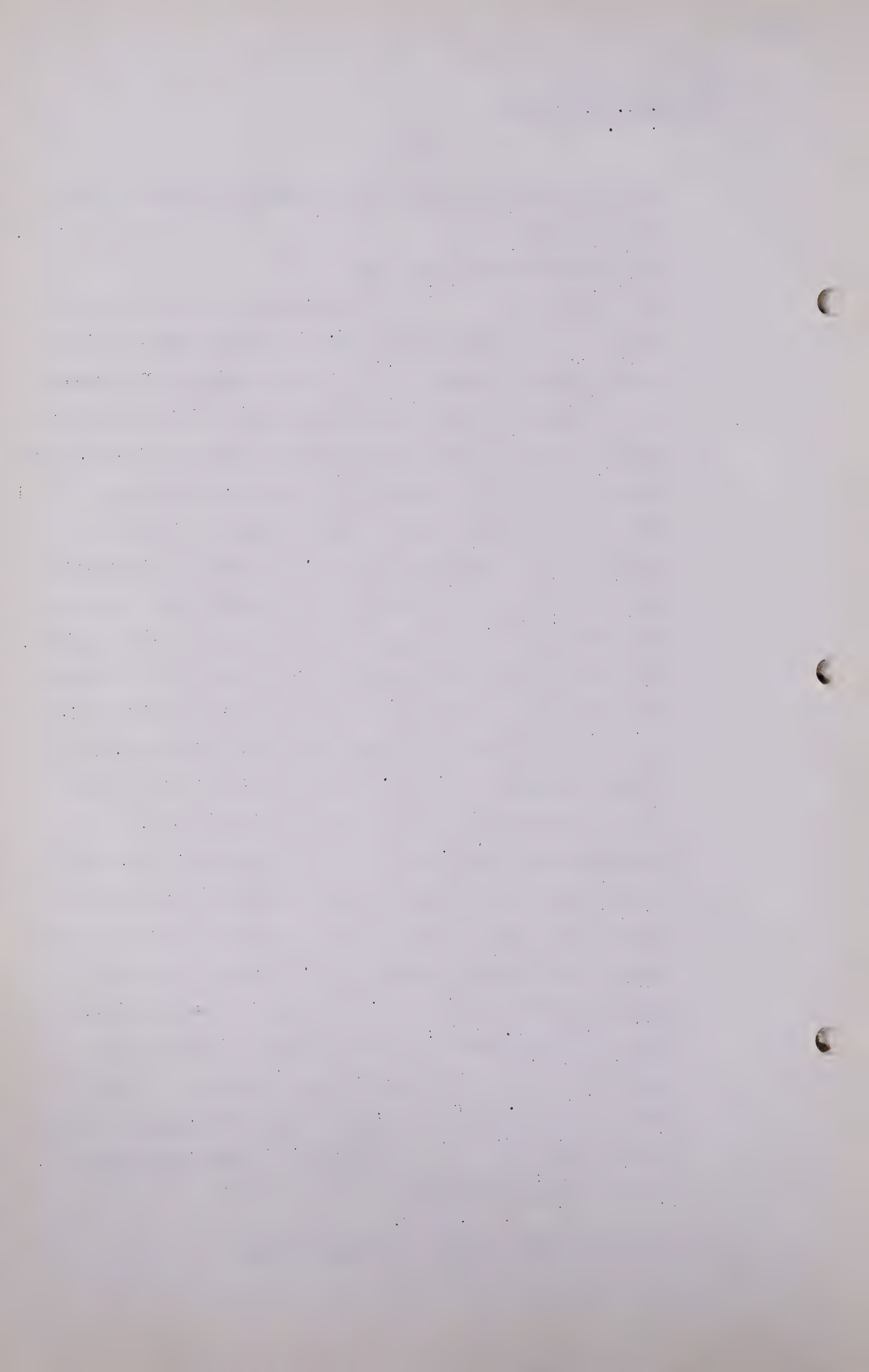
of gas above and below what is regarded as the pay zone,
is that right?

A Yes, as the prolific pay zone.

MR. McDONALD: Mr. Chairman, I do not wish to interrupt my learned friend, but Westcoast Transmission Company made it clear in its opening statement with regard to the supplies of gas for the Province of Alberta, that we were accepting the Board's figures, that we are not disputing anything the Board had to say with regard to 582, or whatever the figure is, and that is taken into account in all our submissions with regard to the use of gas in Alberta. I can put it to the Board quite plainly, that there is not going to be any geological witness who is going to agree with regard to the extent of the Viking field. We have had for many years many estimates. No one has ever agreed. Mr. Davis has consistently been the lowest estimator. The Board has adopted it and, as far as we are concerned, we are going to agree to it, and our submission henceforth as to the practical application of using this gas in Alberta will adopt the submission as has been adopted by the Board. But that does not necessarily mean that Dr. Nauss, in his personal capacity, agrees with Mr. Davis; nor that does not mean that the other geologists who are going to give evidence will agree with him. However, he can carry on. I just want to make sure for the record where the company stands.

THE CHAIRMAN: I think this might be a good time to adjourn, Mr. Steer.

(Hearing resumed after short adjournment)



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THE CHAIRMAN: All right, Mr. Steer?

MR. STEER: Mr. Chairman, in the light of the statement which my learned friend, Mr. McDonald, has just made, I do not intend to proceed to cross-examine Dr. Nauss further with regard to details. I did intend to go into the Viking-Kinsella field and the Princess-Patricia field with regard to discrepancies, but I do not propose to do that now.

Q Dr. Nauss, I take it from your evidence that you are not presenting any figures as to marketable gas before the Board?

A As to the economics of the problem, no.

Q That is right. And your evidence is that there is 1300 billion cubic feet of additional gas discovered since the 1st of January of this year, or since your report J-30 and the other geological evidence was given to the Board?

A Yes.

Q And that 1300 billion....

A Well, as a matter of fact, the main discovery was more, the amount discovered was more, but we have had a downward revision, the main one being in Morinville, and that has been made up for by additional discoveries.

Q And anything new then, I take it, is found in these Edmonton fields on pages 2 and 3? You have got a number of fields there that are new?

A Yes.

Q And the evidence with respect to the amounts to be got from those fields is of the same character that you and I were discussing a little while ago, some strong and

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some weak?

A Yes.

Q And with regard to the Edmonton area, there is no really large field that has been discovered, they are all comparatively small?

A I think that in that list there are some large fields. We do not know that yet.

Q New? But you do not make any computation of the large quantity of gas discovered in any of those fields centred around Edmonton?

A We do not compute the entire reserves of the field, you see, because you cannot. This is not a calculation of the amount of gas that we think is within each of these pools, this is the amount of gas that we think we can see in these pools.

Q That is what the Board is interested in at the moment is what it can see?

A Yes, that is right. So that like the amount of gas, for example, in the Majeau Lake, that might be a large gas field.

Q Quite so. We hope it is. But I take it with regard to the new discoveries, as I have analyzed this list of yours, the largest new discovery which you say can be seen today is, I think, Jarvie with 45.5 billion, am I right in that?

A No, Jarvie is not the largest.

Q Well, what is the largest in this list that you have given?

A Probably Majeau Lake.

Q But you have given....

A The discovery well, or the discovery wells will, each one of them, be fairly equal, whether the discovery well is

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in a large pool or a small pool. One well will only prove up so much acreage, and the higher the pressure the more gas you will have in that particular well proved up by that particular well.

Q Quite so. Isn't this true, that your evidence here today is that the Board ought to find that there is 2892.4 billion cubic feet of recoverable gas reserves in the Edmonton area?

A Yes.

Q And that is all that you can see at the moment?

A That is right.

Q And if the Board is going to find more in its judgment, then they have got to await further evidence to find out?

A Yes.

Q And of the ones that you have given that you say the Board ought to find that they can see at the moment, the largest one of the new ones is Jarvie with 45.5 billion?

A Well, I think we reported on Jarvie before so that it is not new.

Q It is not new?

A No.

Q I think you are right. That was reported on before the Board before and is not dealt with. Well, then, the largest one would be?

A Amisk Lake.

Q Amisk Lake with 40.7?

A Yes.

Q That is the Edmonton area?

A Yes.

Q And in the Calgary area you have Cessford, Countess, Many

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Islands, and Olds, is that right?

A Yes.

Q I take it from what you have said from your Exhibit 4 that the figures with regard to Cessford and Countess, I think you have taken those from the DeGolyer and McNaughton report?

A Yes.

Q That is your evidence?

A Yes.

Q So that the weight of it depends upon what the DeGolyer and McNaughton witnesses will have to say about it?

A What they have already said about it.

Q Yes?

A We based ours on their previous report.

Q Then Many Islands, have we got the details of that in your report?

A No, we have not got all the details.

Q So that we have not got the evidence on which you compute the quantity of gas in Many Islands?

A No.

Q Nor have we the evidence on which you compute the quantity of gas in Olds?

A Yes, the evidence is there.

Q Oh, yes, you have.

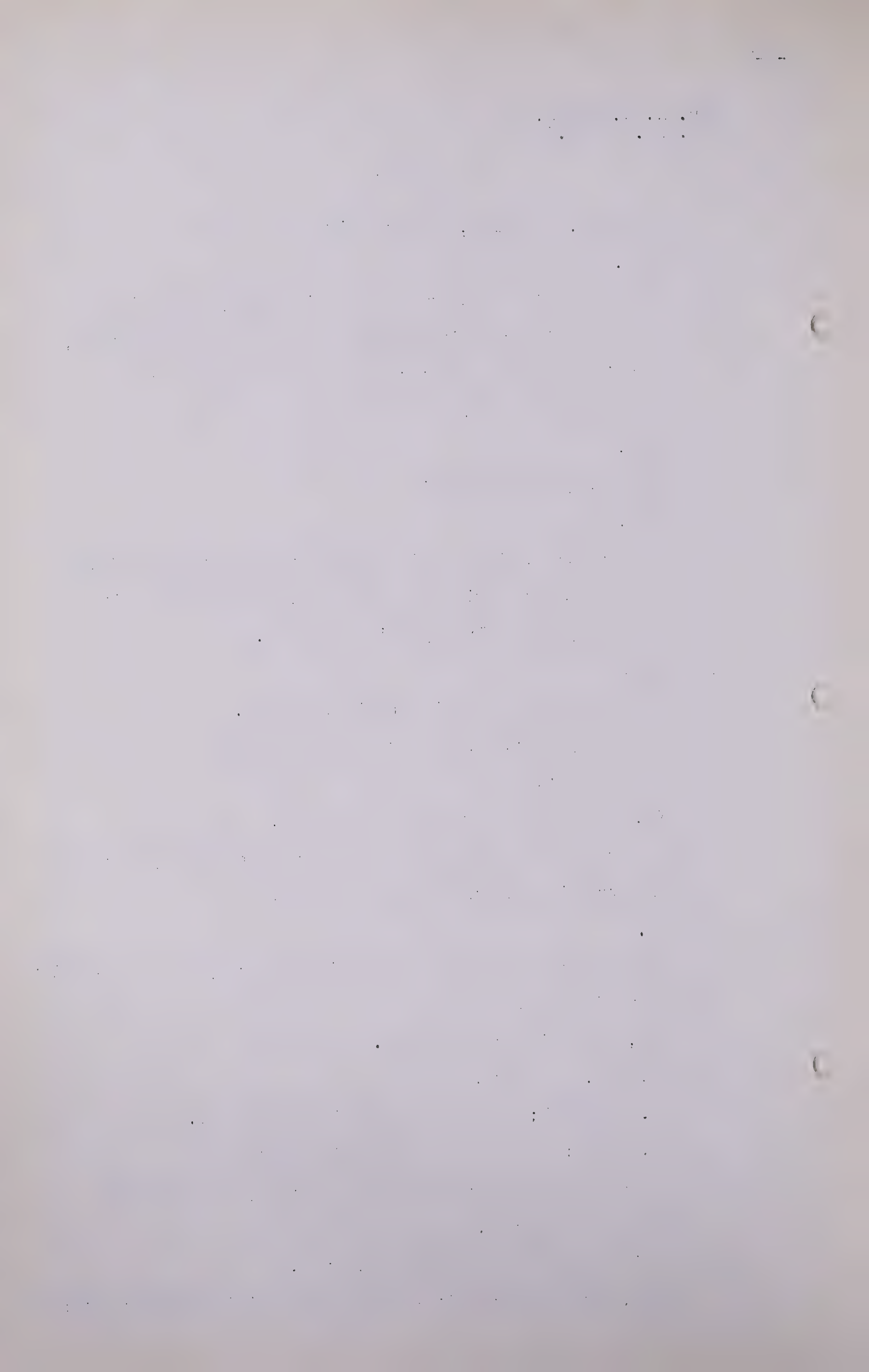
MR. McDONALD: That is at page 71.

MR. STEER: That is right.

Q I suppose you regard that Olds quantity as proved by powerful evidence, do you?

A It is a fairly good estimate, yes.

Q Well, would you put it - I have been dividing your estimates



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up into what is proved by strong and those which are proved by weaker evidence, which is this?

A Well, you are the one that is making the division.

Q Well, you said it was all right. Now, taking Olds, is that strong evidence?

A You tell me, I am not making the division.

Q You agreed that your evidence is based on some evidence which was strong and some evidence which was weak, didn't you?

A And there was a complete gradation between them.

Q Well, which one are you going to put this into? Where are you going to put Olds, are you going to put it near the top, near the bottom, or in the middle?

A In the middle.

Q All right. That is all, Mr. Chairman.

MR. SMITH: If no other counsel have any questions, I have a few questions, sir.

MR. MARTLAND: No questions.

MR. PORTER: No questions.

THE CHAIRMAN: Mr. Nolan?

MR. NOLAN: Nothing, sir.

THE CHAIRMAN: Mr. Mahaffy?

MR. MAHAFFY: Nothing, sir.

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EXAMINATION BY MR. C. E. SMITH:

Q Dr. Nauss, Mr. Steer read to you Mr. Liesemer's submission at the last Joint Hearing, and he read this:

"The division of reserves into proved, probable and possible has been discarded in favour of The American Gas Association Committee definition that every discovery proves a gas reserve."

You agreed with that statement?

A Yes.

Q It goes on:-

"...with the proviso that care should be exercised to limit the area to that proved beyond a reasonable doubt."

You observe that the words "beyond a reasonable doubt" relate to the word "area", that is correct?

A Yes.

Q And, Doctor, do you know, having regard to the words "beyond a reasonable doubt", do you know of any area that is proved beyond a reasonable doubt? I do not suppose you do. Take it to the fullest extent?

A Well, that is why.....

Q It is too fine, I would say?

A That is not an engineering definition.

Q Well, would you mind just answering the question? You do not know of one, do you, that is proved beyond a reasonable doubt, if we take those words?

A Well, the word "reasonable" leaves - the word "reasonable" gives sufficient latitude there that I could say they are

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proved within a reasonable doubt, or beyond a reasonable doubt.

Q Now, was one Turner Valley?

A Oh, we can list many of them.

Q Oh, I did not think you could. I do not know how you can, but you say you can?

A The reason you can is because the words "reasonable doubt" have abundant room for interpretation.

Q Yes, I often have to talk about them to a jury in a criminal court. You realize that is the same language that is applicable in courts of criminal jurisdiction?

A Even if the American Gas Association wrote that definition, it is not a good definition, it is a poor one.

Q I agree with you. I am not quarrelling with you, Dr. Nauss?

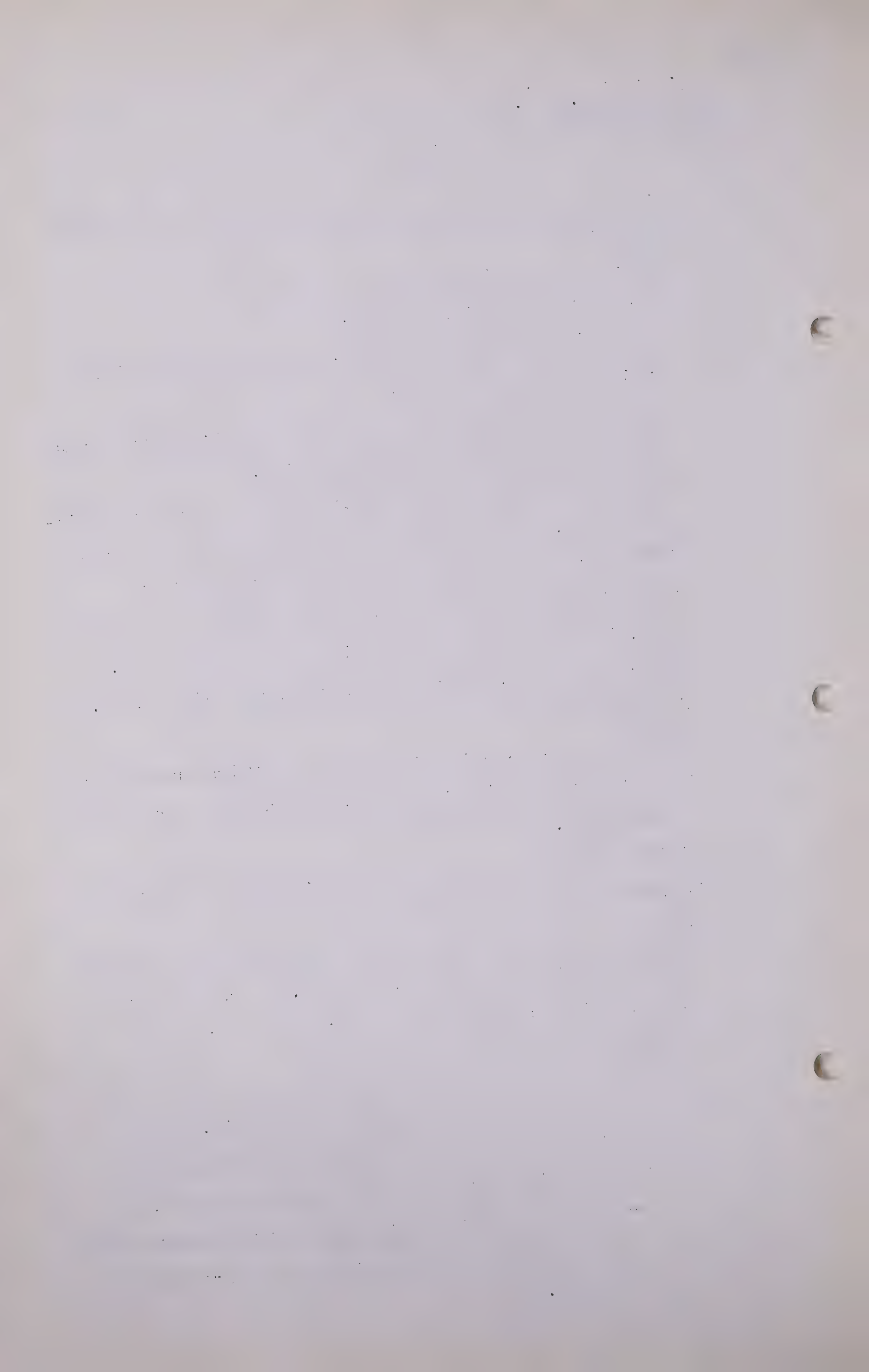
A It should be proved reserves are those which are supported by data such as drillstem tests, core analyses, and these other things.

Q Similar to what you mentioned to Mr. Steer a while ago?

A Yes.

Q Probably you would prefer what the Board has to say by what I think is analagous application. At page 15 of their Interim Report they say this:

"In its analysis of the gas reserve estimates the Board has endeavoured to be realistic. It considers that if the present and future needs of the Province are to be adequately protected, there should be a reasonable expectancy that such gas reserves are available from presently-known discoveries."



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Do you like that language better?

A I like that language, and that is what I think I put in this report.

Q Yes, that is what I probably thought you did too. Now, you had a discussion with Mr. Steer about these terms proved, probable and so on, and because of that, Dr. Nauss, I want you to refer to page 35 of your own exhibit, Exhibit 4, headed "Royal Park", and immediately underneath "Royal Park" in brackets you have the word "probable". there, and I do not think I find it any place else in that exhibit?

A Yes.

Q Could you give me some explanation of that?

A There are several other places where the word "probable" is put in.

Q Are there?

A Yes.

Q All I am getting at is that you have the word "probable" there. You say that there are several others?

A Belloy.

Q Have you ever done what Mr. Steer suggested to you?

A In several instances, yes.

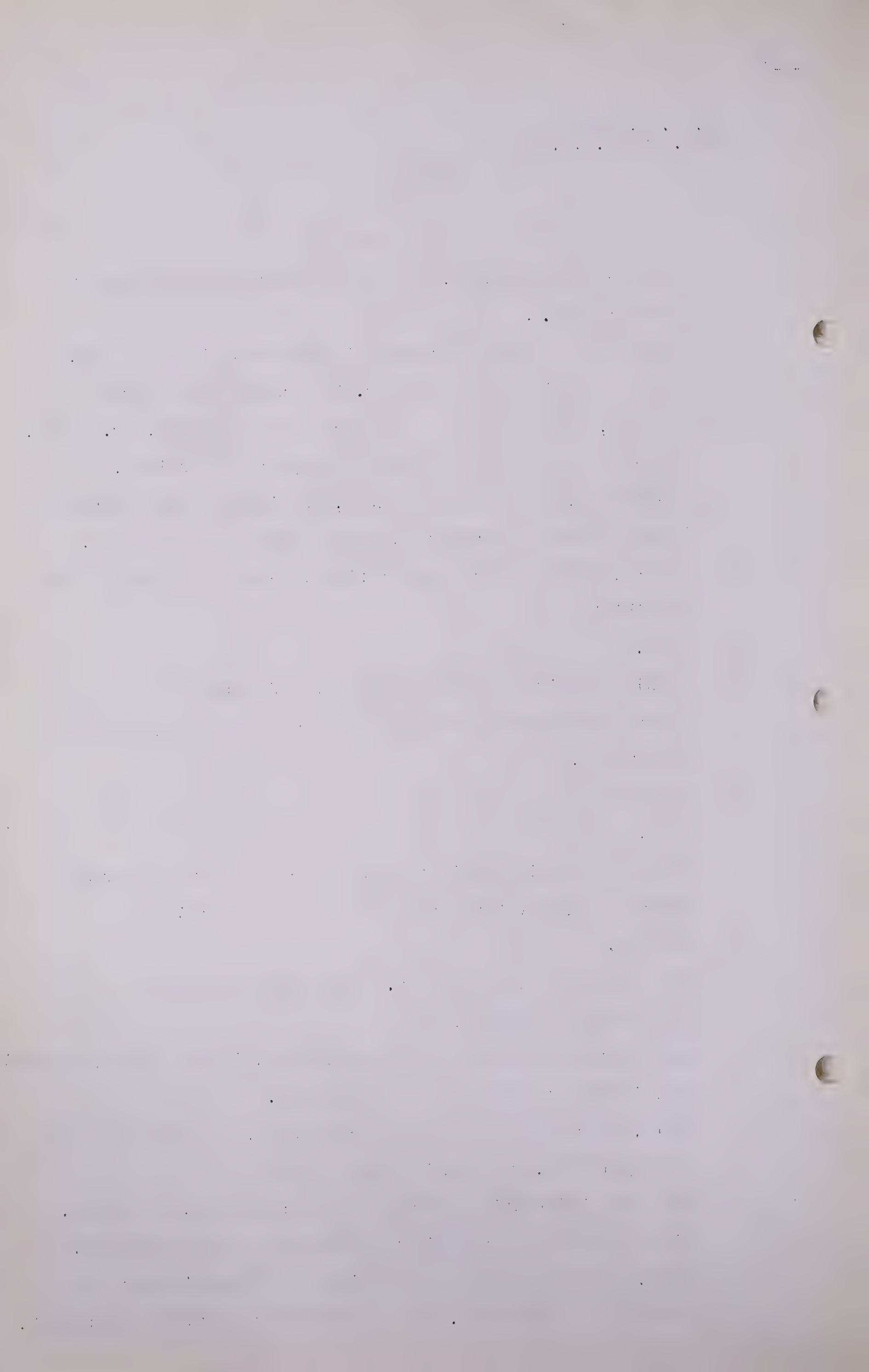
Q But it is not pretended to be complete, is that what you mean?

A No, it is not intended to be complete.

Q Well, where you use the word "probable", as we see it here in Royal Park, what is intended by it?

A That the information there is a little poorer, is poorer. The information available to us was not of good quality.

Q Well, would you say it falls within the Board's idea of reasonable expectancy, the ones that are marked "probable"?



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A Yes, I think it does.

Q You think it does?

A Yes.

Q I do not know whether you are making the distinction in view of what you told Mr. Steer, but it is of some significance?

A You will notice we did not make the distinction throughout. We should probably have left it out in those few instances.

Q Well, there is nothing more that you want to add that you think will help us with respect to it?

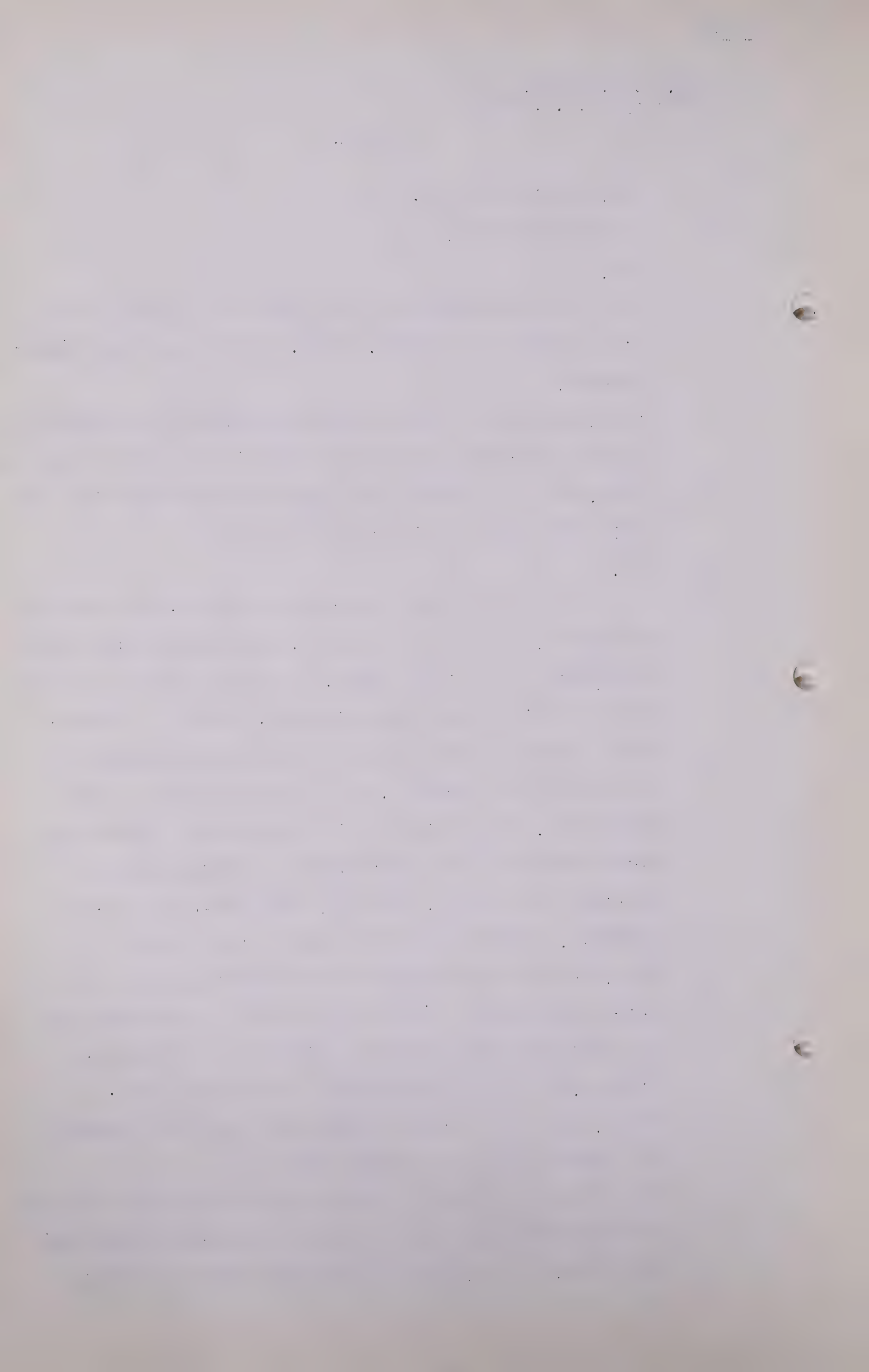
A No.

Q I do not want to rehash everything that Mr. Steer and you discussed. As a matter of fact, he discussed practically everything I had in my notes, so that you will be glad to know I won't be very long with you, Doctor. However, there are two or three general questions with regard to the question of acreage, and I have reference to your Exhibit 4, and having in mind our previous discussions with respect to the ascertainment of acreage and the estimate of acreage, that they hold good, that is, for example, a single well ordinarily for 2000 acres?

A Yes, one well not supported by structure maps such as you might obtain from a seismic map proves the existence of gas only in an area having a diameter of the whole, 9 inches, and you do not know the area beyond that.

Q Well, but in that type of thing, have you still adopted the general idea of the 2000 acres?

A Yes, we have adopted the general idea of 2000 acres because we believe when you add up all these one-well discoveries that there is a reasonable expectancy that the average



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area will not be less than 2000 acres.

Q In other words, you say you feel that at least any increases over 2000 will take care of any decreases when the thing is drilled out, if and when it is drilled out?

A Yes, that is merely our judgment.

Q And purely as a matter of information and illustration, will you turn to page 24, Doctor, to what is called "Lily", and if I understand the map at page 29, "Lily" seems to be one of these identical one-well strikes. You have got a circle around it, from which I take it to be one-well, and I take it to be about a mile, and yet on Lily I think you have cheated yourself a bit, and gave it only 1000 acres. Is there any particular reason for that?

A Yes. The thicker the sand is, the more chance it has to extend. The thicker the gas sand is the more chance there is of that gas bearing porosity extending over a wider area.

Q Yes?

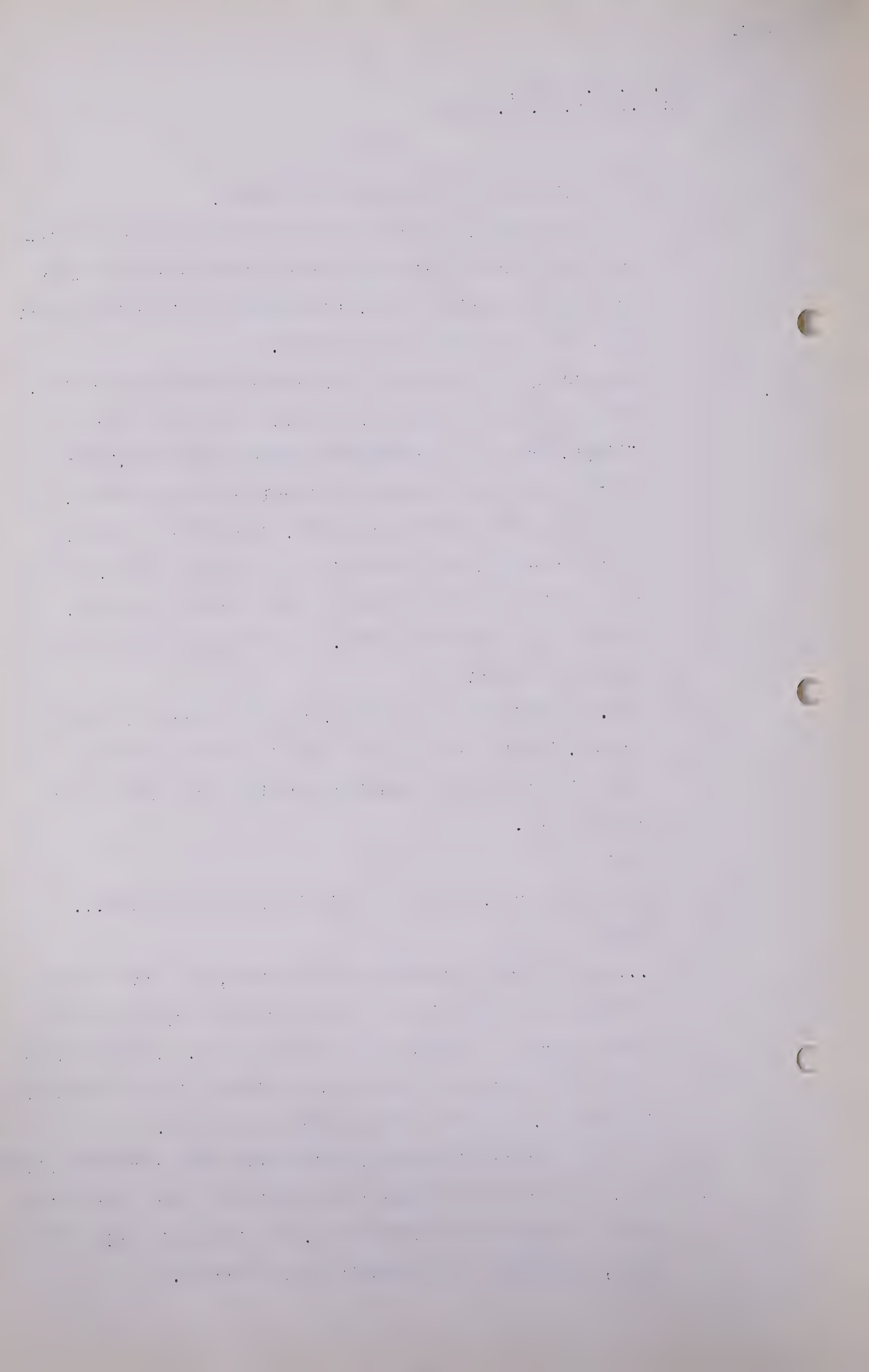
A In other words, if the dip is 10 feet every mile...

Q Yes?

A ...and you have a thickness of 10 feet, you have about a mile before the dip of your reservoir bed, the top of your reservoir bed dips below water level. If the thickness is 20 feet, you have about 2 miles; if the thickness is 30 feet, you have about 3 miles and so on.

Q Are you illustrating that particularly with regard to Lily?

A Yes. So that the thicker the sand is the more chance it has to extend over a wider area. In Lily it is only 7 feet, therefore we reduced it to 1000 acres.



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Q If we have a thickness of so many feet and we have to adopt this 2000 acres that you do, is there any yardstick that can be applied by way of reducing the 2000 acres to 750, or that 7 feet would cut it in half, or anything like that?

A It is not as simple as that. It could have been related like that, but if the entire sand is full of gas and there is no water in that sand, the chances are it will extend further than if that small thickness of gas were resting in water.

Q Applying what you have just said to Lily?

A Yes.

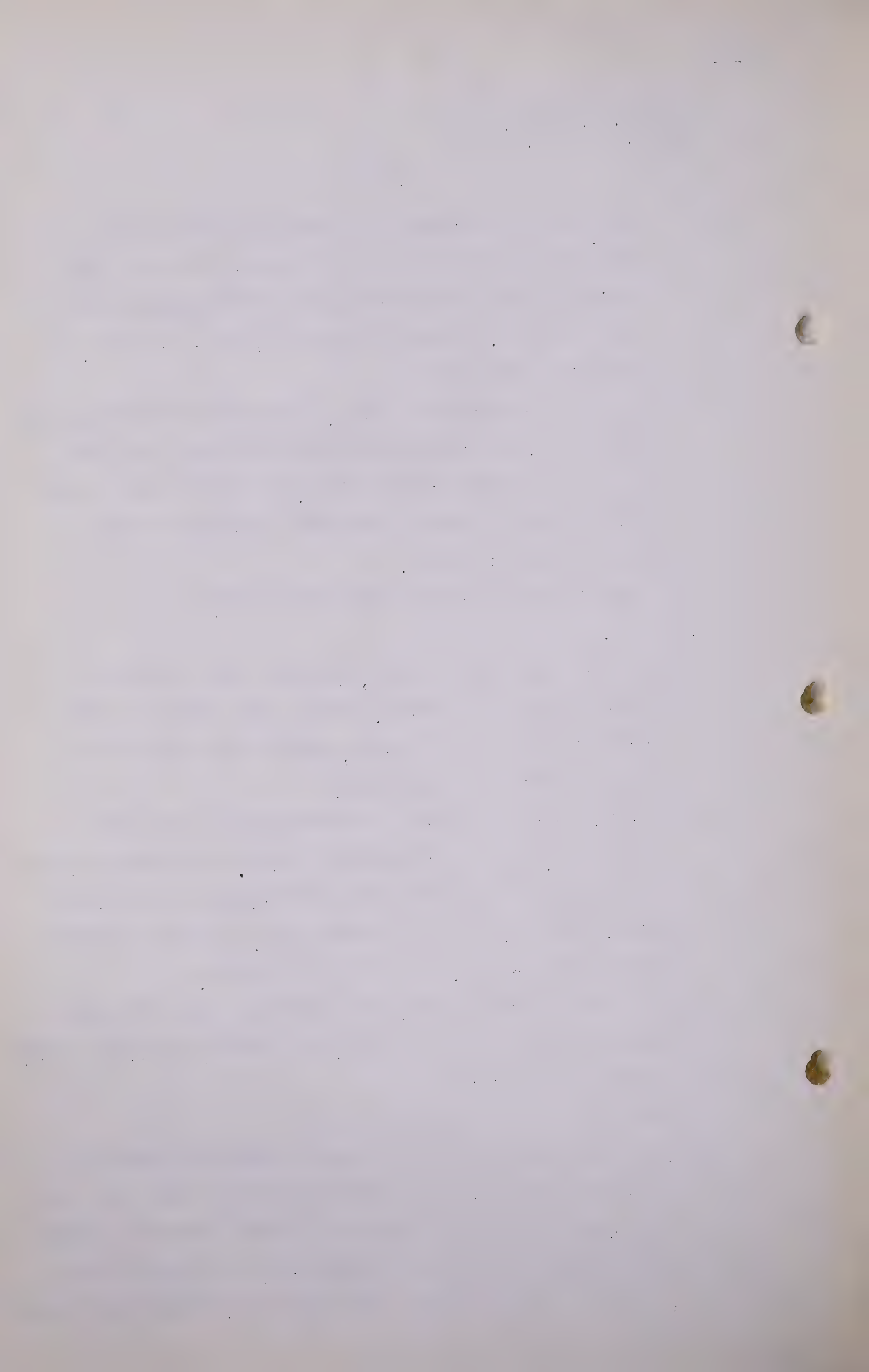
Q You have got Lily, 7 feet, and what else you want to talk about I do not know, but you have got it at 1000 acres instead of 2000 acres, and can you detail to us why you arrive at 1000 acres?

A We just cut the acreage to something below the 2000 acres because the thickness is 7 feet. The actual acreage we do not know. If that well was drilled on the seismic high, and if we had that seismic map, we would probably extend the acreage, but we do not have it.

Q So that it being 7 feet, you figure you had better cut your 2000 acres to 1000 acres, is that it? Is that a fair way of putting it?

A Yes.

Q Is there anything else you can say that will assist the Board by way of acreage estimates that you have not told us, anything you can think of, Doctor? There is nothing new as far as I can see from Exhibit 4 to what you have previously told us about your method of calculating acreage?



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A Well, the determination of acreage is based on quite a number of things. In some instances the acreage is outlined by wells, for example, at Medicine Hat.

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Q No, but what I meant was we have already discussed that, is there anything new since your last hearing that you can assist the Board? Not that I know of.

A These determinations are based on seismic maps in several instances, core maps in several other instances and on structure maps in other instances.

Q You have not, if I remember, noted the various fields where you have had seismic maps and these other things available to you and where you have not, have you?

A We have not, no.

Q I think you mentioned one or two yesterday morning but Exhibit 4 does not contain a statement such as you have had the opportunity of examining so and so's map, or anything of that nature?

A No. In general we have not had an opportunity of examining the seismic maps.

Q So far as Exhibit 4 is concerned the Board does not know whether your estimate of acreage - whether or not you have seen seismic maps or not?

A Where we had seismic maps we have placed that in evidence, the discussion.

Q Have you placed anything in evidence. You mean yesterday?

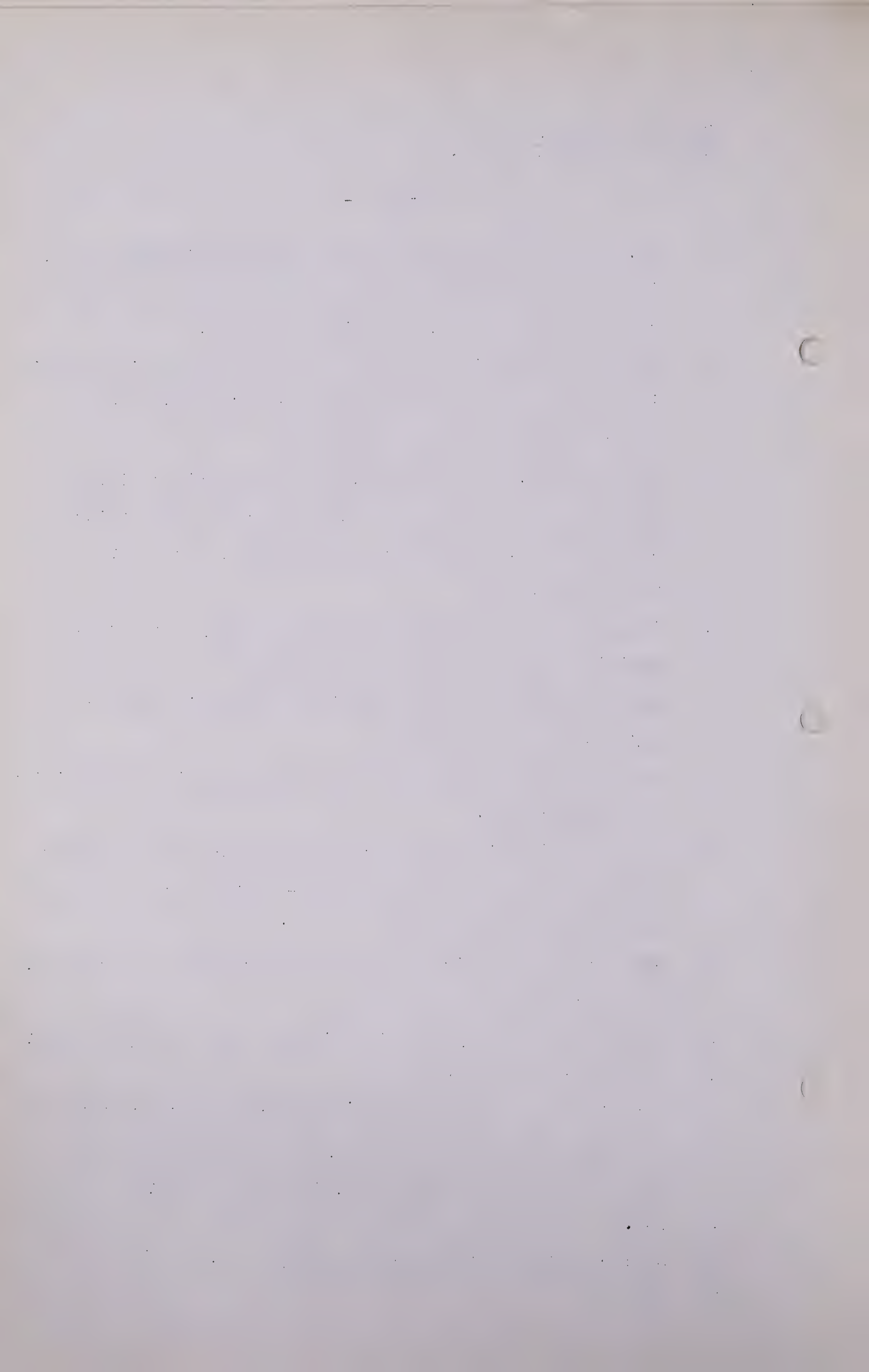
A And at previous hearings.

Q But with respect to these fields dealt with in Exhibit 4 you have already told us all the information you can about seismic map examination, is that correct?

A Yes.

Q So I can find it in the transcript?

A Yes.



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Q Now, Doctor, coming then to the question of thickness, can I assume that in every case you had an opportunity of examining electrologs?

A In practically every case, yes.

Q I understand in some cases you referred to electrologs and in other cases you did not. I wondered whether or not you did not have an opportunity of examining them in practically every case?

A Electrologs are fairly readily available. Only in very recent wells are they not available. In most instances electrologs have been available.

Q I am talking about Exhibit 4 only?

A Yes, I am too.

Q You can tell me now if in most instances you have had the assistance of electrologs when you are figuring out the thicknesses?

A Yes.

Q Is there any particular important instance in which you did not have that opportunity?

A Yes, at Bailey-Olds we have not examined the electrolog on that. There are several instances, yes.

Q Well, are they what I would call important, that is where you come out with a really good sized reserve?

A I think Belloy. It was not examined.

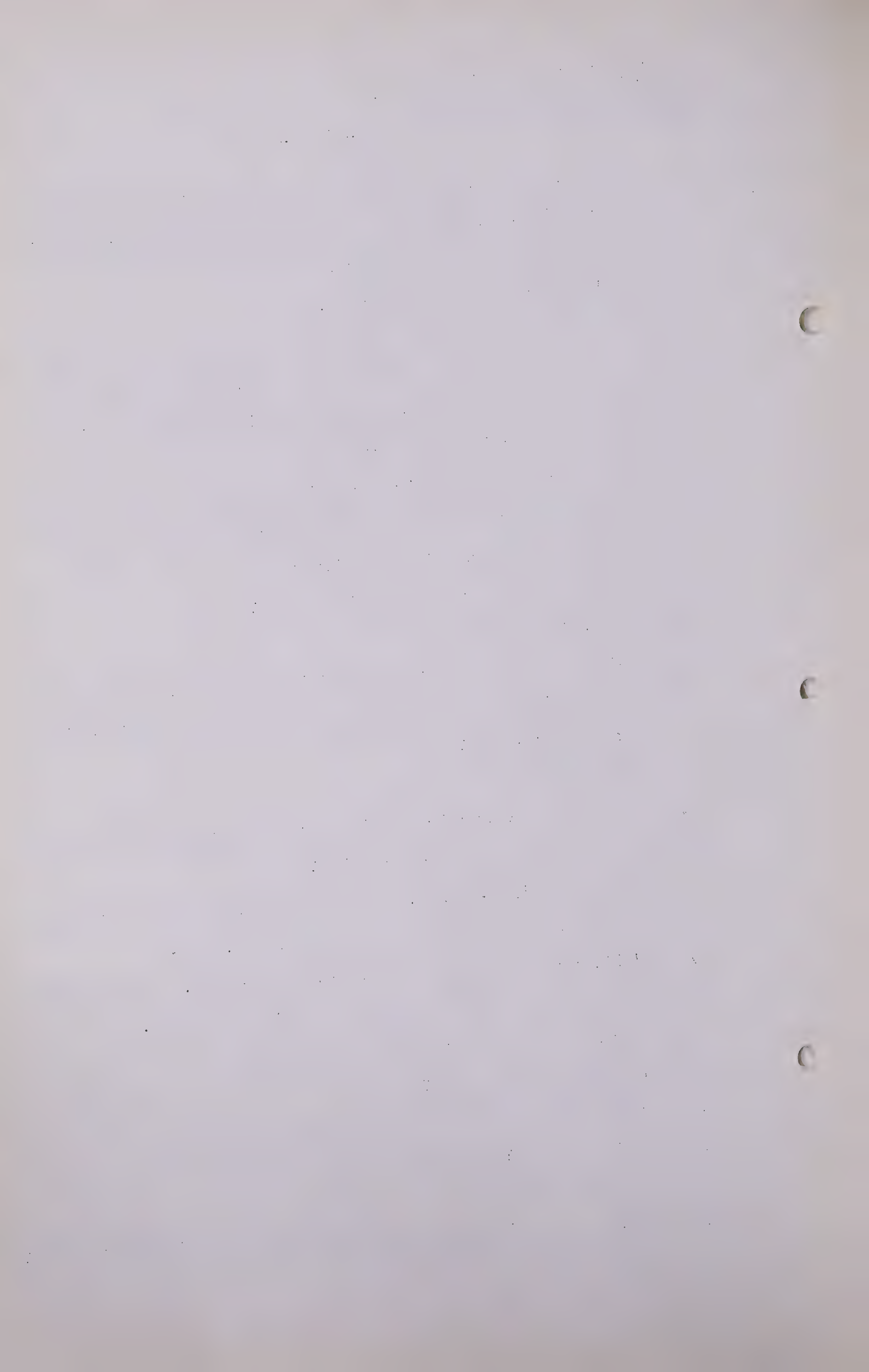
Q What page is that on?

A 70.

Q 7 did you say?

A 70.

Q Yes, that is in your Addenda. Any others similar to that?



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A There are no other large reserves, no.

Q That is what I have in mind?

A No.

Q And would you turn to Morinville for a moment? I am not going to dwell with you very long on this. At page 30 you have an estimated average thickness of 40 feet, Doctor. Down at the bottom you will observe. Do you see what I am referring to?

A Yes.

Q I take it, Doctor, you have examined the electrologs of the various wells you have detailed on pages 29 and 30, is that correct?

A Yes.

Q And to a large extent from that examination you have arrived at this average estimated thickness, is that correct?

A From that, together with drill stem tests which indicates where the gas is in that section.

Q You have given us those?

A Yes.

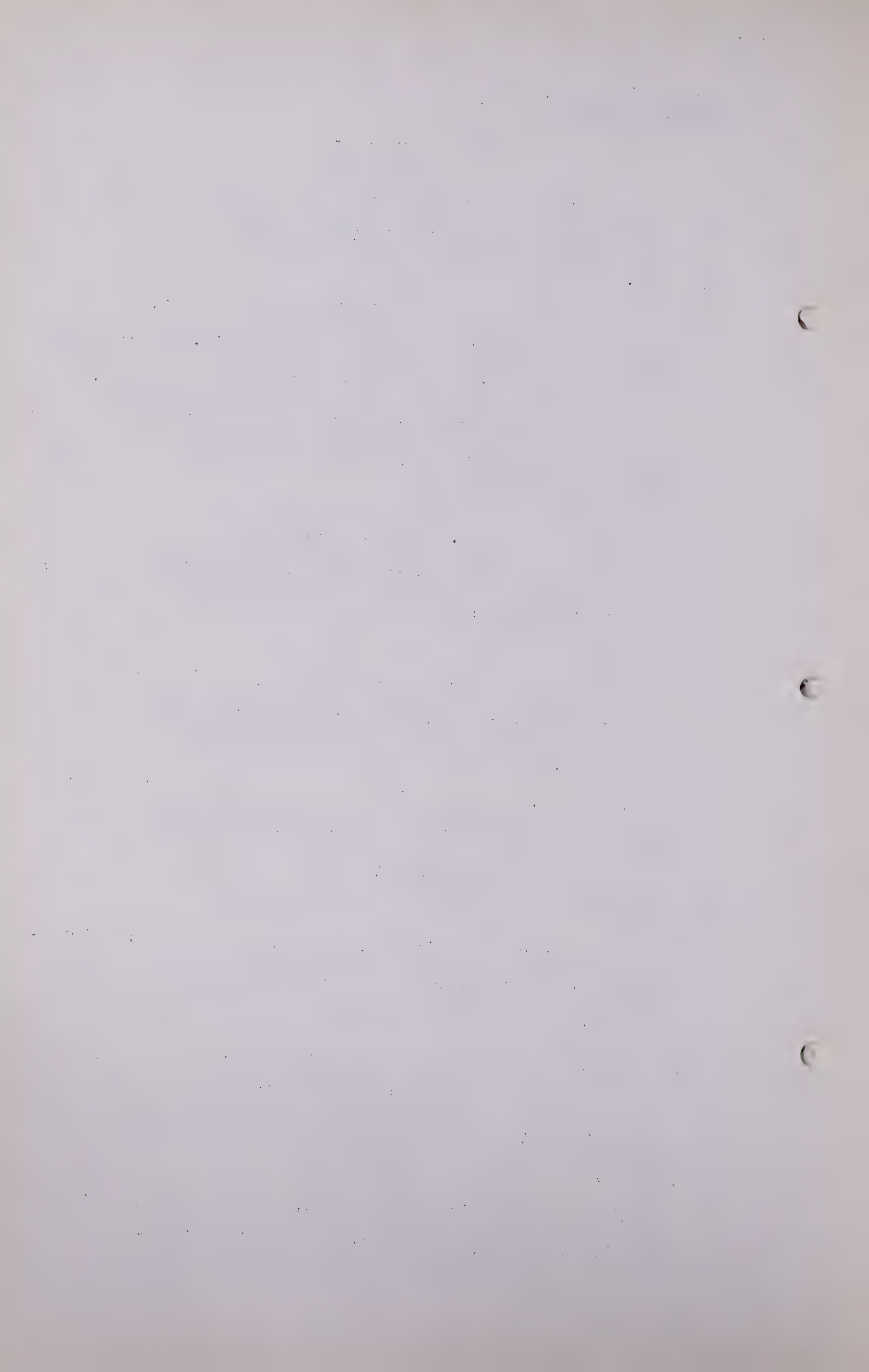
Q I wonder can you give us, Doctor, the electrolog interpretation with regard to each of the wells you have dealt with here?

A I would have to have the electrologs, yes.

Q You have not any working notes with you that makes that available?

A No.

Q What I would like to have had, and probably you can give it to us, is your interpretation with respect to



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each well. Do you understand what I am getting at?

A Yes.

Q So that the Board could compare and find out what average we can get, having that detail in mind. That might be gotten from your working notes?

A Yes.

Q Now, with regard to connate water, is there anything new in regard to our general discussion. First, with respect to porosity, we will say. Is there anything new in regard to our general discussions insofar as Exhibit 4 is concerned? Let me put it this way . . .

A In the Peace River area we have had quite a number of core analyses, new core analyses to go by, yes.

Q Well generally speaking, Doctor, where you have used the word "measured" that is where you have had an opportunity of core analyses throughout Exhibit 4, is that right?

A Yes.

Q Where you have used the word "estimated" with regard to porosity you have not had core analyses or probably not sufficiently, is that correct?

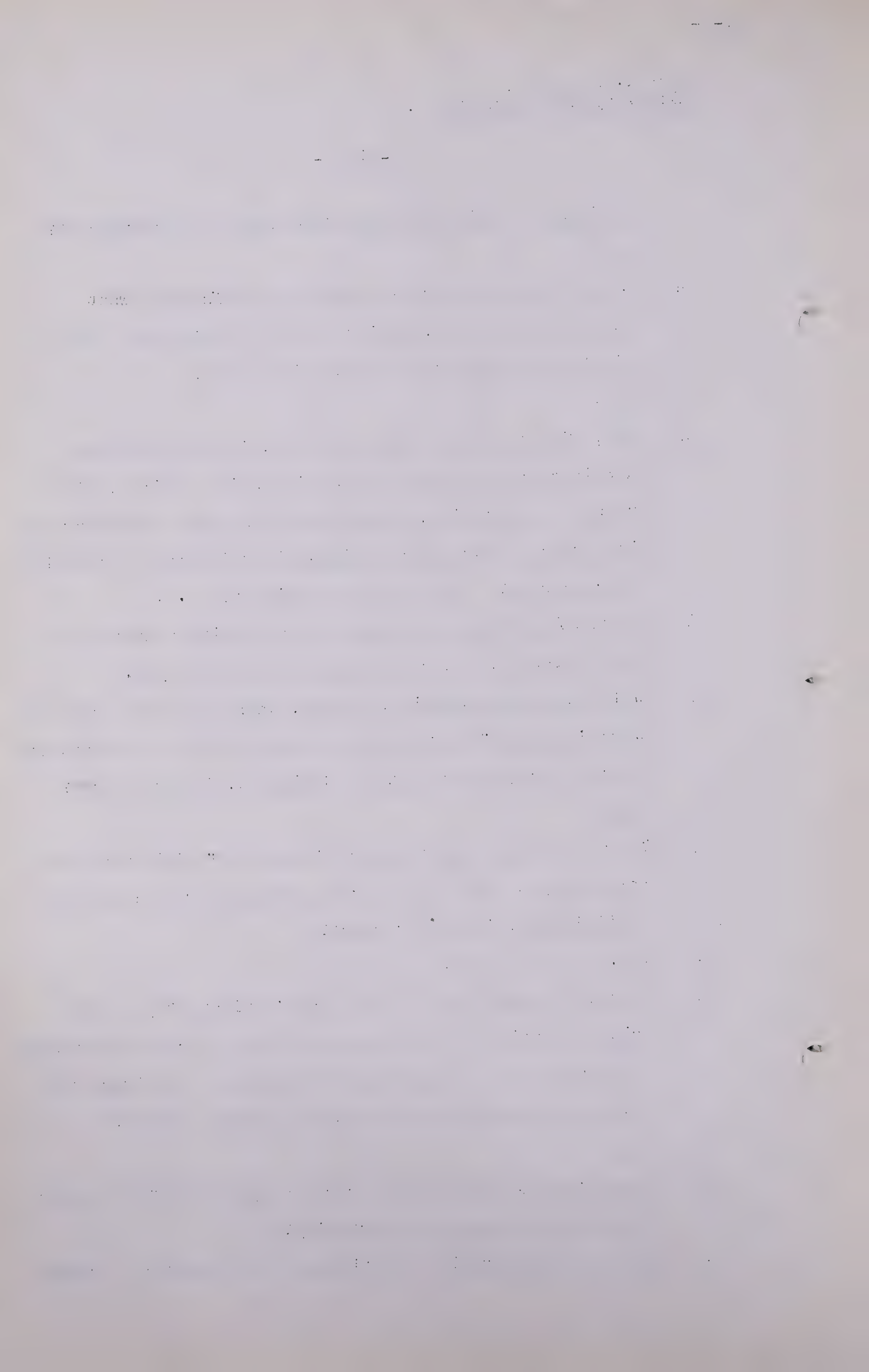
A Yes, that is right.

Q I take it where you use the word "estimated" you have tried to arrive at an estimate of gas on actual knowledge and experience of some other field where you figure the sand was approximately the same, is that correct?

A Yes.

Q "Measured", you have had a core analyses and "estimated" you have not had that opportunity?

A In the case where it is estimated there might be either



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no core analyses or insufficient to give an average.

Q I thought I used the words "or insufficient", either none or insufficient?

A That is right.

Q I take it the same applies to connate water?

A Yes, of course, yes.

Q While we are mentioning connate water, will you still look at page 30 of Exhibit 4, and I notice connate water 20%. If I am correct you can look at Table A (Revised) and there you originally had it 9%. Make certain I have it right.

A Yes, I remember the figures.

Q There must be something since you prepared Table A (Revised)
.

A The 9% figure was obtained from a core analysis of the Pacific Calahoo No. 1 well and we did not believe -- that is abnormally low connate water. Since we decided that the Morinville pool was a different pool than Calahoo that application of that connate water to Morinville would not be sound, so we re-estimated the connate water in Morinville.

Q But does your re-estimate constitute a further examination of core from any of the wells that are in the present pool called Morinville?

A No.

Q It is just an upward revision?

A That is right.

Q Because you figured it was too low in view of what you

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found out since about the pool areas, is that right?

A That is right.

Q Doctor, I have an awful lot of pages marked but I think I can skip a lot of them in view of what has gone on before. By the way, have you had an opportunity -- I think you have had an opportunity of seeing the Delhi submissions, I think prepared by DeGolyer and McNaughton, is it?

A The previous ones, not the ones they are presenting at this hearing.

Q But you did the ones that were presented in Edmonton?

A Yes.

Q I notice in one or two instances that you mentioned to Mr. Steer you have accepted some of their figures?

A Yes.

Q Did you ever think of accepting all of their figures? You would do a lot better, wouldn't you, if you did? You know what I am talking about. Their gross is considerably more than yours, is it not?

A Yes.

Q Have you compared your figures as to acreage and thickness and so on with regard to any particular field dealt with in the DeGolyer and McNaughton report?

A We have made some comparisons, yes.

Q The reason I ask that, I just happened to look up Acheson, the first one in there. I find they have an acreage of 2794 for the Viking sand against your 1680. On the other hand they have an average of 1093 against your 2080. I wondered if you could assist us by helping us to find out why the discrepancies between the two

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figures. Have you looked at it in that way at all?

A Well, in regard to acreage it is clear that in view of the fact we have very little information, if any, on acreage two estimators are bound to come out with different results.

Q I am not criticizing either estimate but I wonder if you could help us?

A That is the answer right there.

Q Two estimators come out with different results?

A Because of lack of information, sound information.

Q It might be that two estimators come out with different guesses, if I understand you correctly?

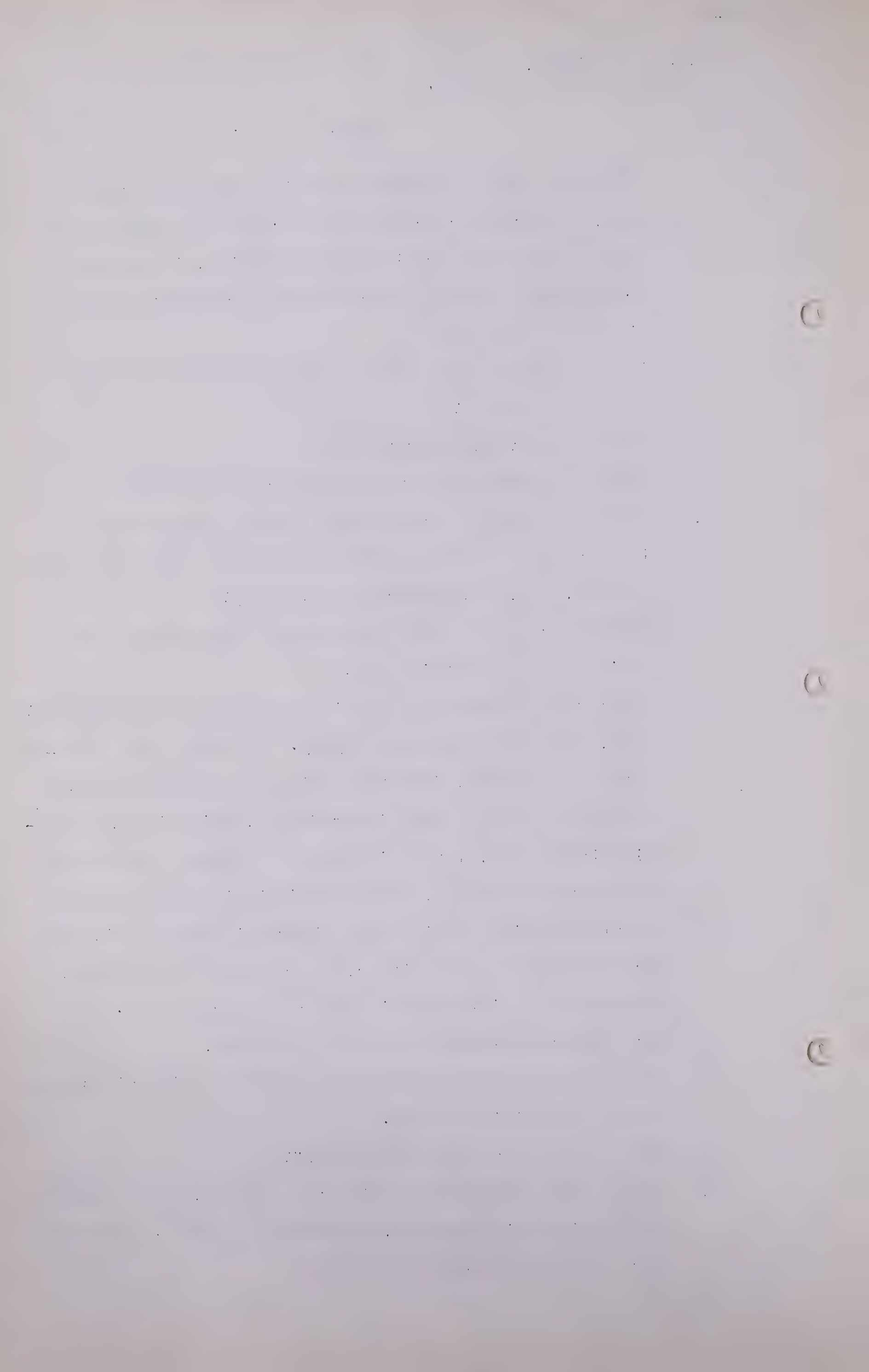
A With regard to acreage you can call them guesses and I won't be insulted this time.

Q Did I use that word at one time when I was offending you? Well, we are in agreement anyway. So much for that. And I take it, Doctor, just to continue and presently I am looking at one of your bigger fields, which is the Boyle-Amisk Lake field, I take it that if DeGolyer & McNaughton come out with a total of about 68 billion feet and your total approximately in round figures is 46 that will be accounted for by the difference in guesses in acreage, plus maybe a difference in other interpretations. Or is there anything you can add to help us?

A That these figures should differ on fields in this status is not surprising at all.

Q What do you mean "in this status"?

A We are just beginning to discover them. When two wells were drilled in Redwater, you would not know - you could not know how big that field was.



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Q I mean is there anything more you can help us with? I am looking for information. I am not criticizing anybody. It seems a little odd to a layman that two people would come up with such a difference, that is all.

A The reason is the approximate nature of estimating gas reserves particularly. . . .

Q Did you say "human nature"?

A Approximate nature of estimating gas reserves, particularly when they are in an early stage of development. We are certainly in a very early stage of development here in Alberta.

Q Yes. But with regard to the Boyle-Amisk Lake . . .

A When 10 or 15 more wells are drilled in that area we will be able to have an accurate calculation of the gas reserves.

Q I take it when you have 10 or 15 more wells the Board might then say that there is a reasonable expectancy that such gas reserves are available, is that what you mean?

A No, in attempting to calculate gas reserves for this purpose we are assuming that we can do so and that we are going to accept the data that we have available.

Q I am not criticizing you by saying you should have more. You have to take what you can get. But I am serious in this. In view of your answer about the 10 or more wells the Board might expect that information before they will adopt any question of reserves without them. That might be their proper duty, might it not?

A That is something I cannot comment on.

Q Probably I am putting you up on the Board and I should not do it. Will you refer to page 16, your Bremner field?

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Looking at your drill stem tests I take it they are just as nice a dequence of drill stem tests as geologists would like to find, wouldn't they? I do not mean necessarily in the amount, but the amounts that are continuously there?

A Yes, from 3625 to 3691 they took five drill stem tests and each obtained large flows of gas.

Q Is there any particular significance in that?

A I think the thing it does show is that the sand is homogeneous in quality so that when you go down deeper the flow rates do not change. One reason of course is this, that three of those tests had the packer set at 2661, the same spot.

Q Does that assist you in any way in estimating your average thickness?

A These drill stem tests are very important in determining thickness.

Q That being so, your 25 feet would not look to be out of the way?

A There is more to it than that. There is the matter of porosity. Is all of that porous? In addition to that the 25 foot thickness is the average thickness over the area and will be different than the thickness in the discovery well.

Q Quite. But as I say that does assist you in at least arriving at the 25 feet average?

A Yes.

Q I am with you, Doctor, here.

A That is right. It is important.

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Q And at page 13, Calahoo. Was that previously in your Morinville report?

A Yes, it was. It was included in the Morinville area.

Q It was included in the Morinville area?

A Yes.

Q So if we are comparing Table A (Revised) we are using Morinville and come up with 784 against 200 and something, I do not know what it is, but as against the present estimate. This Morinville 27.4, I take it, should be added to your present Morinville before we start looking over this?

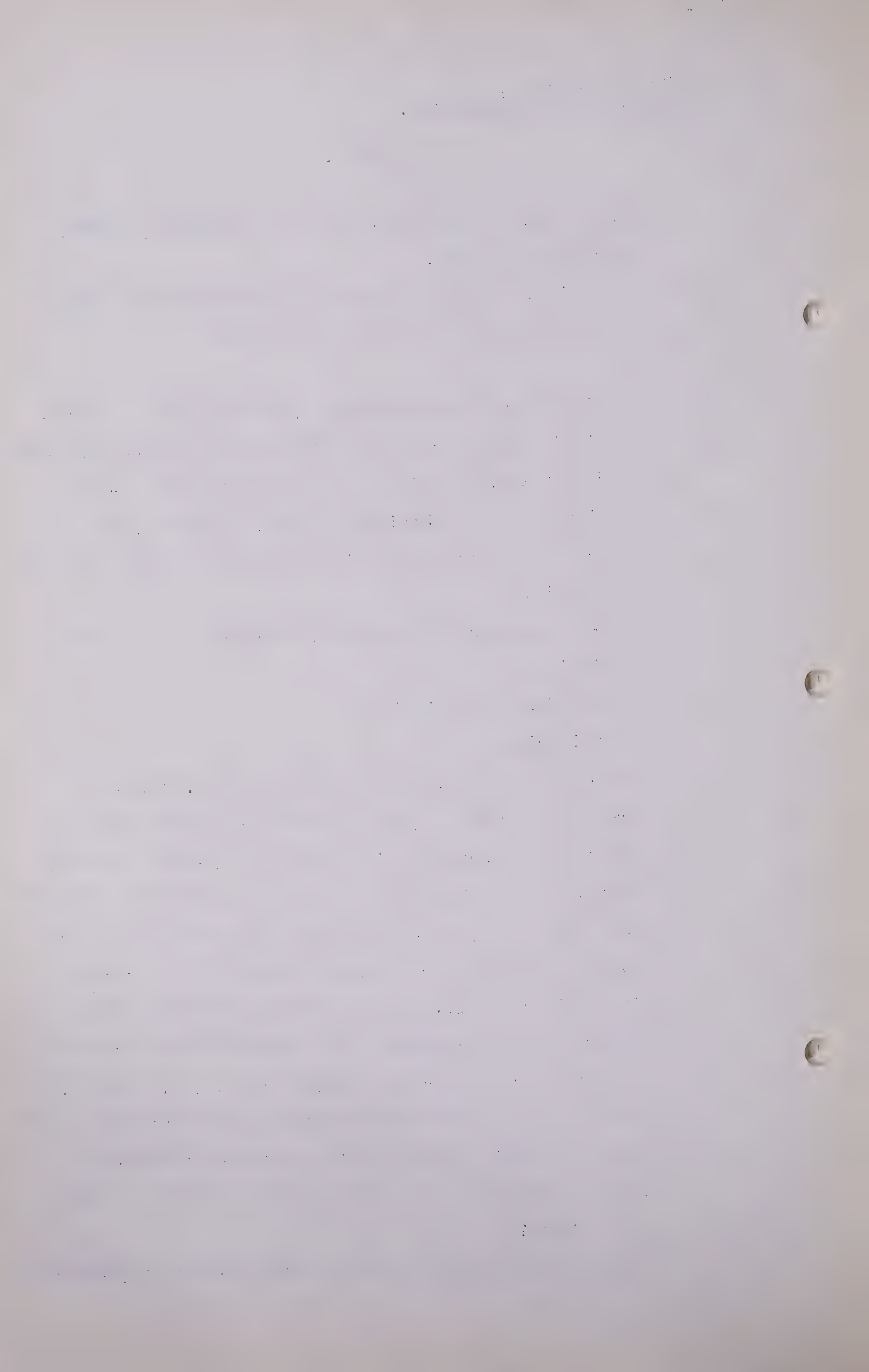
A Yes. The present Calahoo was included in the other Morinville.

Q In the Table A Morinville?

A That is right.

Q Now Jarvie was mentioned by you or by Mr. Steer or probably by both of you. I referred a moment ago to DeGolyer & McNaughton with respect to Acheson or something, to some field where they were considerably higher than you. If you look at page 21 dealing with Jarvie. The total of the recoverable reserves in the Viking Glauconitic was 11.2 and the Basal Cretaceous sand 32.6. If you have not compared them I suggest that DeGolyer & McNaughton came up respectively with 1.6, 3.8 and 13.3, or a total of 18.7 billion against your 46 billion. Can you add anything more in this particular instance to what you told me when I referred to it before in some other field?

A Often these things are due to differences in information



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available. There is a tremendous volume of information goes into the calculation of these reserves and the companies themselves keep the information confidential.

Q Quite.

A So that certain pieces of information may be available to me that are not available to somebody else and vice versa. So that those are also difficulties that cause different estimators to vary in amounts.

Q There is nothing insofar as Jarvie is concerned that you know of whereby their information would be different from yours and because of that they get a different answer?

A In order to satisfactorily answer your question, I would have to compare the two in detail.

Q Probably you would have to have their working papers as well?

A Yes. Well, I think it would help.

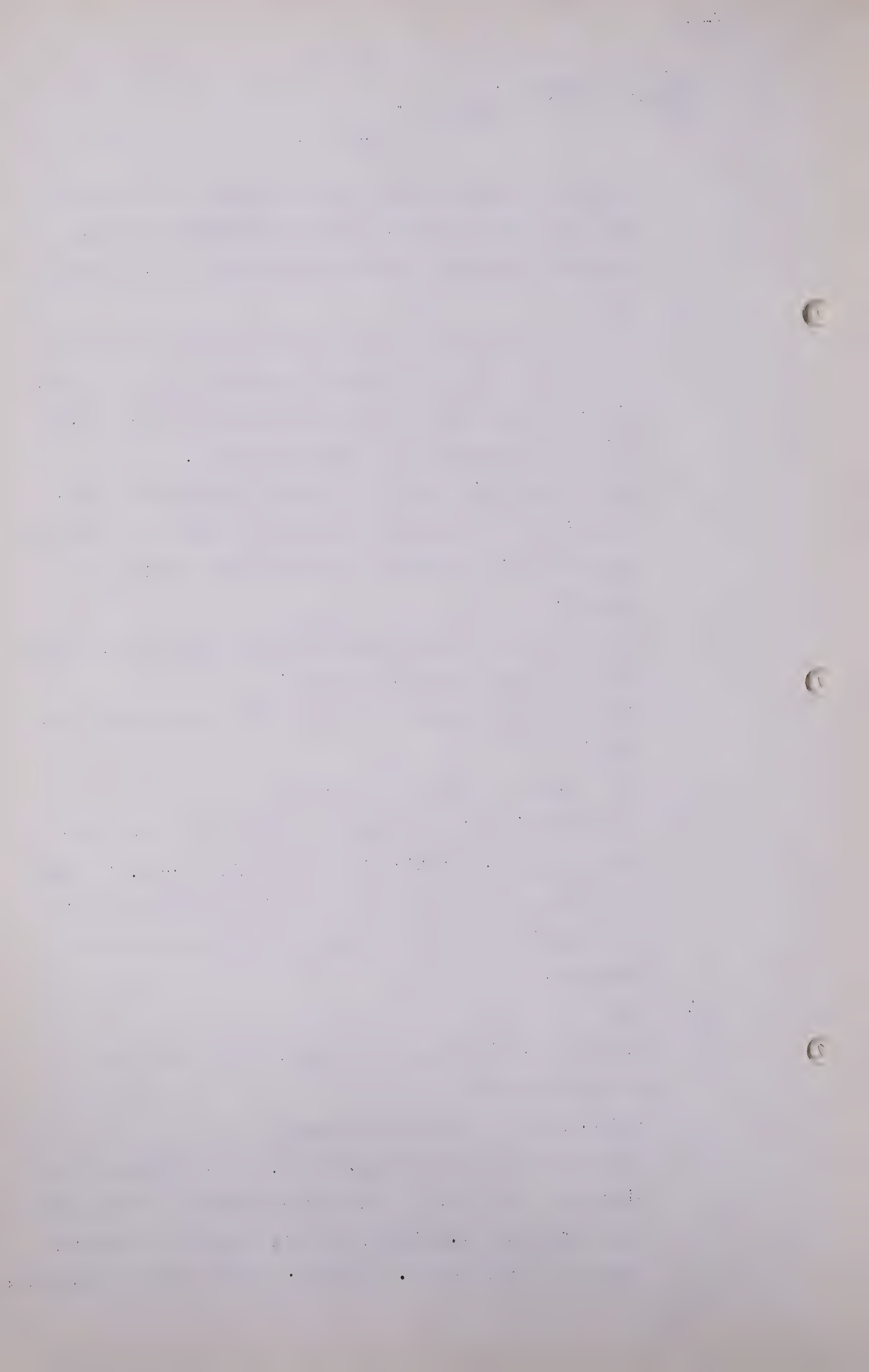
Q Well I won't bother you further with that. Jeffrey on the same page, I notice is another 1000 acres. I suppose the explanation given before applies there because it is primarily 10 feet thickness and you have got your estimate?

A Yes.

Q By the way, with regard to Legal, is that the way you pronounce it?

A Legal, yes. It is a French word.

Q That was discussed with Mr. Steer, and I am not going to discuss it very fully. We will deal with pages 23 and 24 where you have 11.7 MMMcf, that is because of the discovery of a new sand in the basal Cretaceous that produced



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gas, is that right?

A Yes. The Basal Cretaceous produced gas in that well and not in the other.

Q And your 11.7 is added to your Table A 58, I think it was. You got up to 62.6 in this and previously I think you had 58, so we add this 11.7 and that gives us the total, is that correct?

A Yes.

Q And Majeau Lake, I believe you mentioned that before. You have the area there of 2000 acres and your estimated thickness is 40 feet. I take it your explanation previously given, that is with the 40 feet depth you stay with your 2000 acre idea?

A That is right.

Q That is why we distinguish it from Jeffrey and that other one?

A I would like to point out that the regional dip for that part of Alberta would be something like 30 feet per mile. At that rate with 40 -- that is a 40-foot thickness, but the over-all all thickness from the top of the first gas sand to the bottom of the gas is somewhat greater.

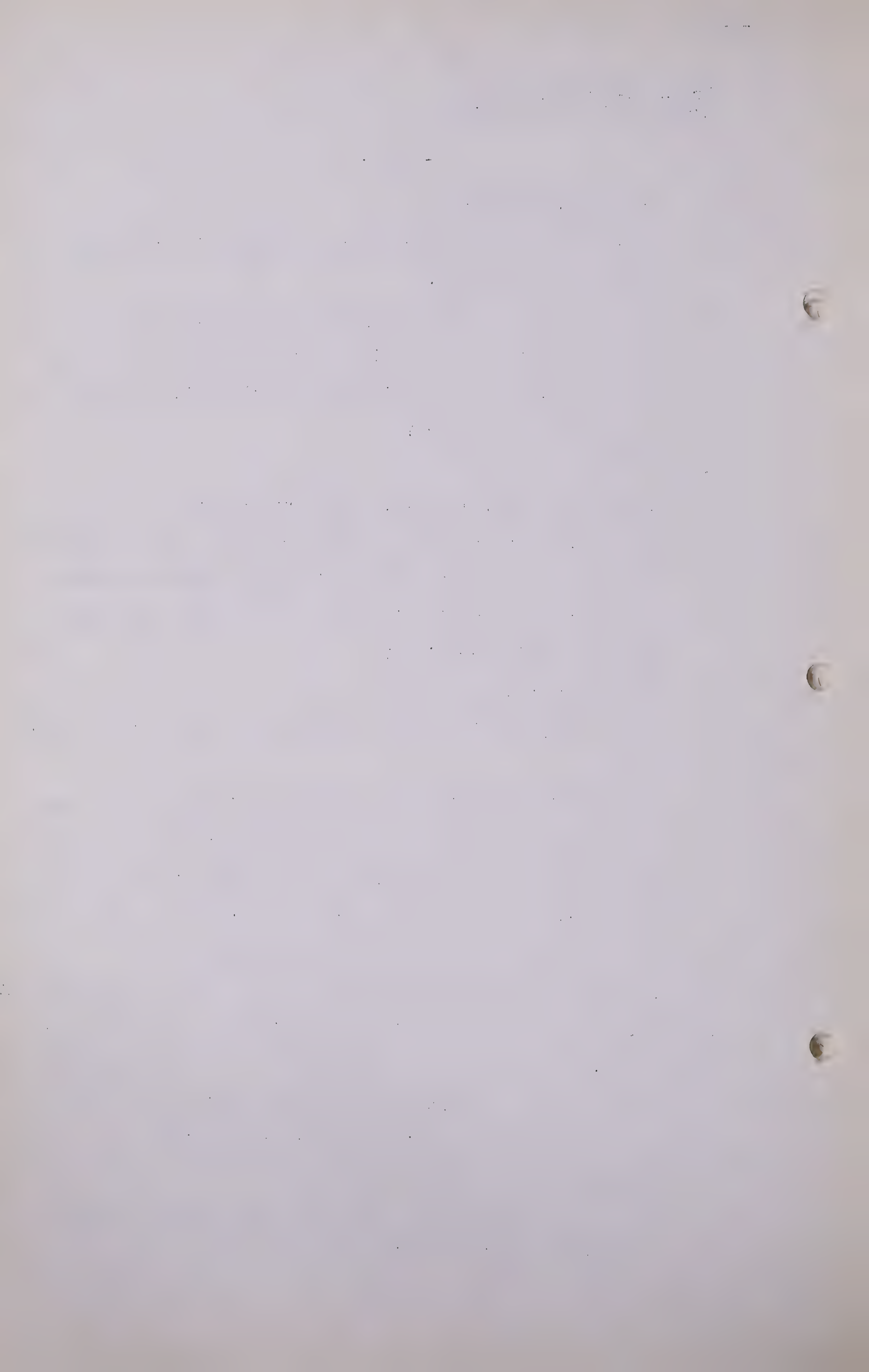
Q Are you giving me your interpretation of the electrolog now?

A No, I am giving you an interpretation from the drill stem tests. You see the top of the Madison is at 4210 and the bottom of the last gas flow was 4301, which is 91 feet.

Let us say that the dip was 30 feet per mile.

Q Now one minute . . .

A You could go three miles from that well before the top of your reservoir bed dips below the water level, so



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that with these gentle dips, 2000 acres, as long as there is a continuity of the reservoir and you have the gentle dips you can expect a large area. In fact, 2000 acres I think is on the low side, particularly for a sand which has gas throughout the thickness of 91 feet.

Q Let me ask you this with regard to your thickness, is this a well in which you had an opportunity of examining the electrologs?

A I believe so.

Q Have you got your interpretation of that with you?

A No, I have not.

Q Can you secure it for us, Doctor?

A Yes, we can.

Q Page 27, Manawan Lake, just one question. How far is it between Eldon No. 1 and Bailey-Long Island No. 1?

A It is approximately 1 mile.

Q O.K., that is all. Now with regard to Picardville on page 31, you mentioned yesterday morning, Dr. Nauss, another Canadian Delhi. I do not know whether it is No. 3.

A Canadian Delhi No. 3.

Q If I got the short note correctly you say, since you prepared the report -- have you any information about Canadian Delhi No. 3 or are we to await somebody from Delhi?

A I have no information available here. It is obtainable, I imagine.

Q I imagine we can get it when they appear?

A Yes.

Q You have nothing to help us with?

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A I have nothing.

Q Now page 32, still dealing with Picardville, and your recovery of g s 80% gives you 26.4. Have I got my note correctly that your Table A (Revised), your recoverable was 90%? Can you add anything to what you have already said as to why that is so now?

A In Table A (Revised) it was 90% and that was Picardville, was it?

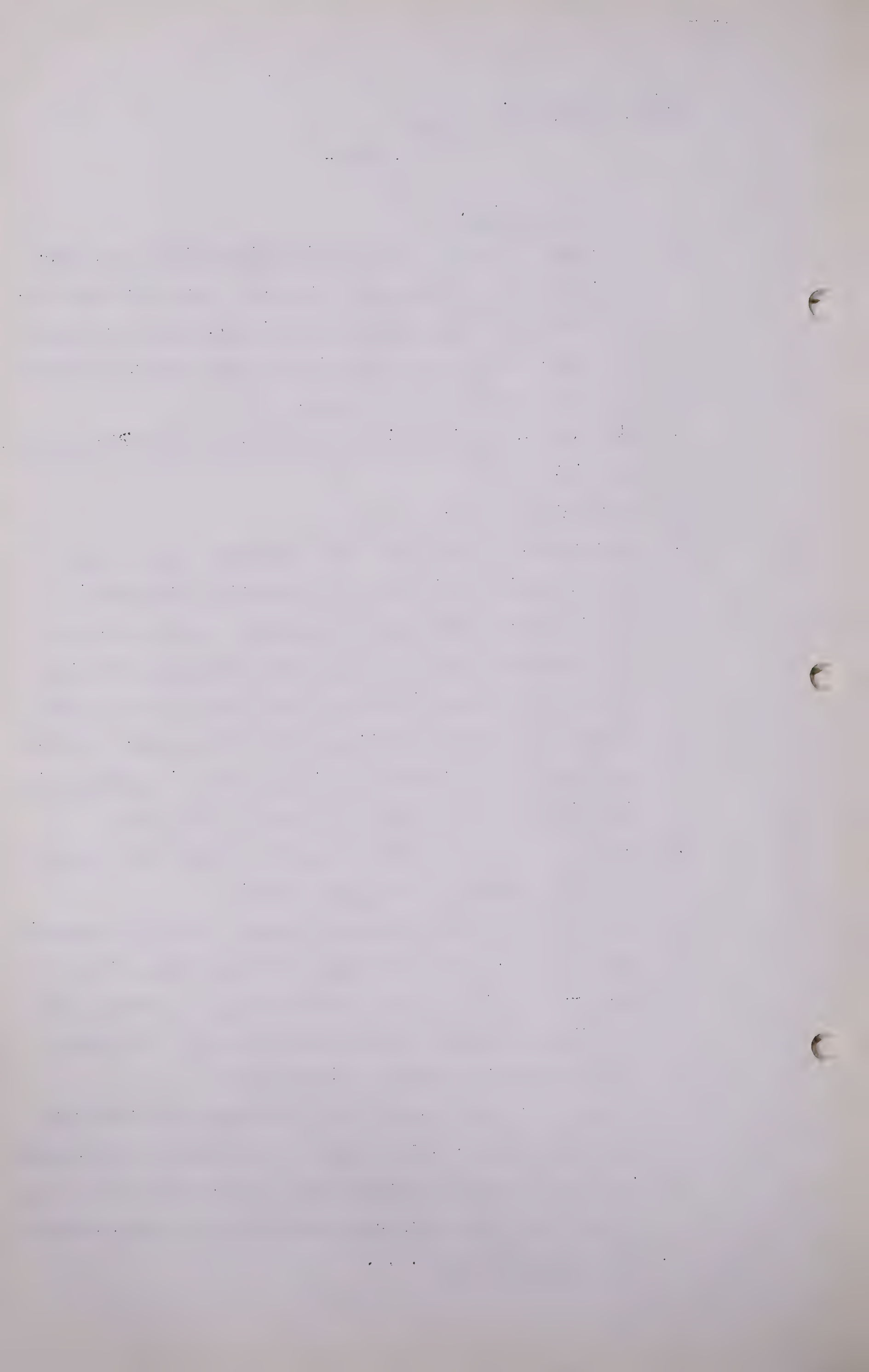
Q Picardville, yes.

A Picardville, it is 80%. The reason for that is this that you will notice that the reservoir pressure is 914 pounds. At 100 pounds abandonment pressure there is approximately 10% of the gas left underground and the 90% figure was applied to the gas that was recoverable down to an abandonment pressure of 100 pounds. So that the 80% in this case of the gas in place is practically identical with the 90% of the gas to 100 pounds.

Q Will that same explanation apply to other places where we find a similar difference occurs?

A That same explanation applies except only in an approximate way. We have used the 80% figure rather than the 90% --- we have replaced our 90% figure in general with 80% figures because there is approximately 10% less at an abandonment pressure of 100 pounds.

Q I hate to repeat it, but if I understand you correctly your 80% figure - let us take the 20% that is left, that includes gas left at abandonment and all the uses of gas on the lease and every way that gas can be used, wasted and everything else . . .



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A Yes. Wasted gas and shrinkage due to the extraction of hydrogen sulphide and other impurities. Those are the main items.

Q And it now includes what gas is left at abandonment but which previously did not?

A The 90% figure previously did not, no.

Q Yes?

A No.

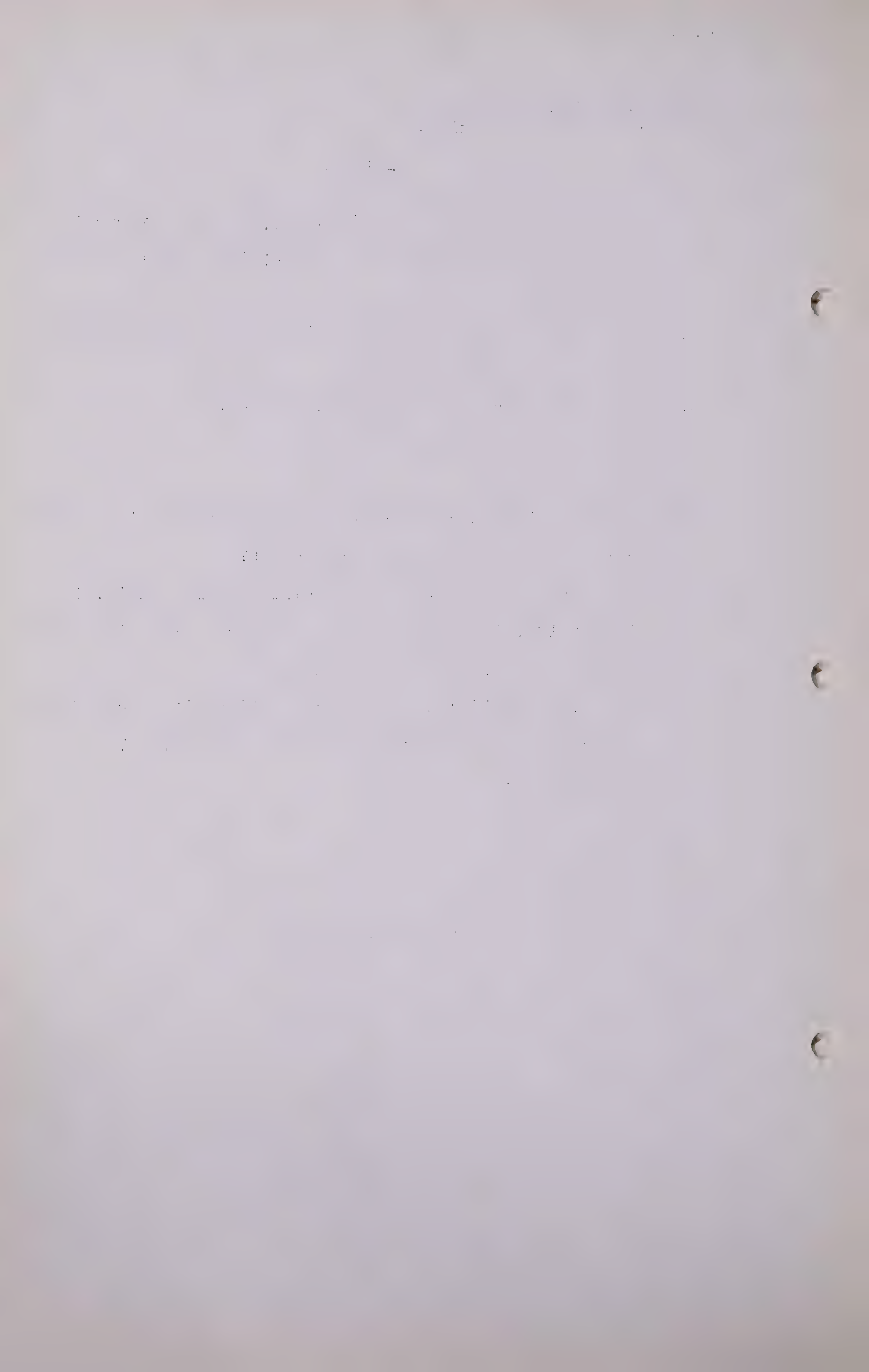
Q And the difference between the 80 and the 90 is to take care of the gas left at abandonment?

A Yes, that is right. But generally the 10% basis, it is not 10%, it depends on the pressure. The higher the pressure the lower the percentage.

Q Have you considered that in connection with each of the fields you have designated in your new Table A?

A Yes, we have.

(Go to page 158.)



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Q The Oliver Lake, would you look at that at page 33?
Oh, I won't bother you with that, it has been dealt with generally in another manner. The word "probable" I have already dealt with that, too. Oh, yes, I think there is one other question, page 50, Doctor. Will you refer to that, Little Smoky Lake, right at the top of the page. The first sentence reads as follows:

"Four wells have been drilled in the general area and only one encountered commercial amounts of gas."

I wish you would expand that expression, "commercial amounts of gas" a little, will you, Doctor? We are getting close to economics maybe there but I would like to know what you had in mind.

A Well, by "commercial amounts", what we meant was indications that a commercial gas well could be drilled. In other words, when that would produce something that we thought on completion would produce at a daily rate of something like a million feet or more.

Q Could we take that as what you had in mind, a million feet or more?

A Yes, we had in mind in order to be commercial these Alberta wells would have to produce when completed about a million cubic feet a day.

Q That is what you had in mind when you used the term "commercial amounts"?

A That is right.

Q I think you told us yesterday with regard to Spirit River, Doctor, commencing at page 51, I think you said your acreage, you got the information and adopted that

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information from the Hudson's Bay Company, is that right?

A Yes.

Q It is not estimated in any way by yourself, you have just taken their figures?

A No, it is copied from their report, which I understand they are going to present.

Q Is that true throughout for thickness, porosity and everything else?

A No, the other figures are first hand figures. We made the other calculations ourselves.

Q Everything but acreage?

A Acreage is the one item that was taken from their report.

Q Doctor, there is one well I think I have mentioned and I think you have a very short summary, where they got 8 million feet, I think, on a test per day and at the bottom you have "well abandoned" or something. Can you give us anything about the question of abandonment on that? Do you remember the well I am talking about?

A That was in evidence here?

Q In Exhibit 4, page 8, Big Lake. You have there a note, "Gas flow 8,000 Mcf., no water," then at the bottom, "Status" - I take that is the status of the well - "abandoned". I wonder if you can give us a reason. Was that because they need pipe, or what is it?

A Well, that was drilled by a small company and in order to complete it as a well they would have had to have set pipe which would have cost another \$10,000.00.

Q Be careful now or Mr. Steer will be up on economics again. You mention \$10,000.00. Go ahead.

A I won't entirely ignore his knowledge. Anyway, that

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pipe would cost ten or fifteen thousand dollars to complete that well as a gas well. The company is very small and they have other things to do with their money. They could not sell that gas.

Q That is a question of economics?

A I think it is a very interesting case, though, that should be pointed out. Here is a small company which can not afford to complete it as a gas well.

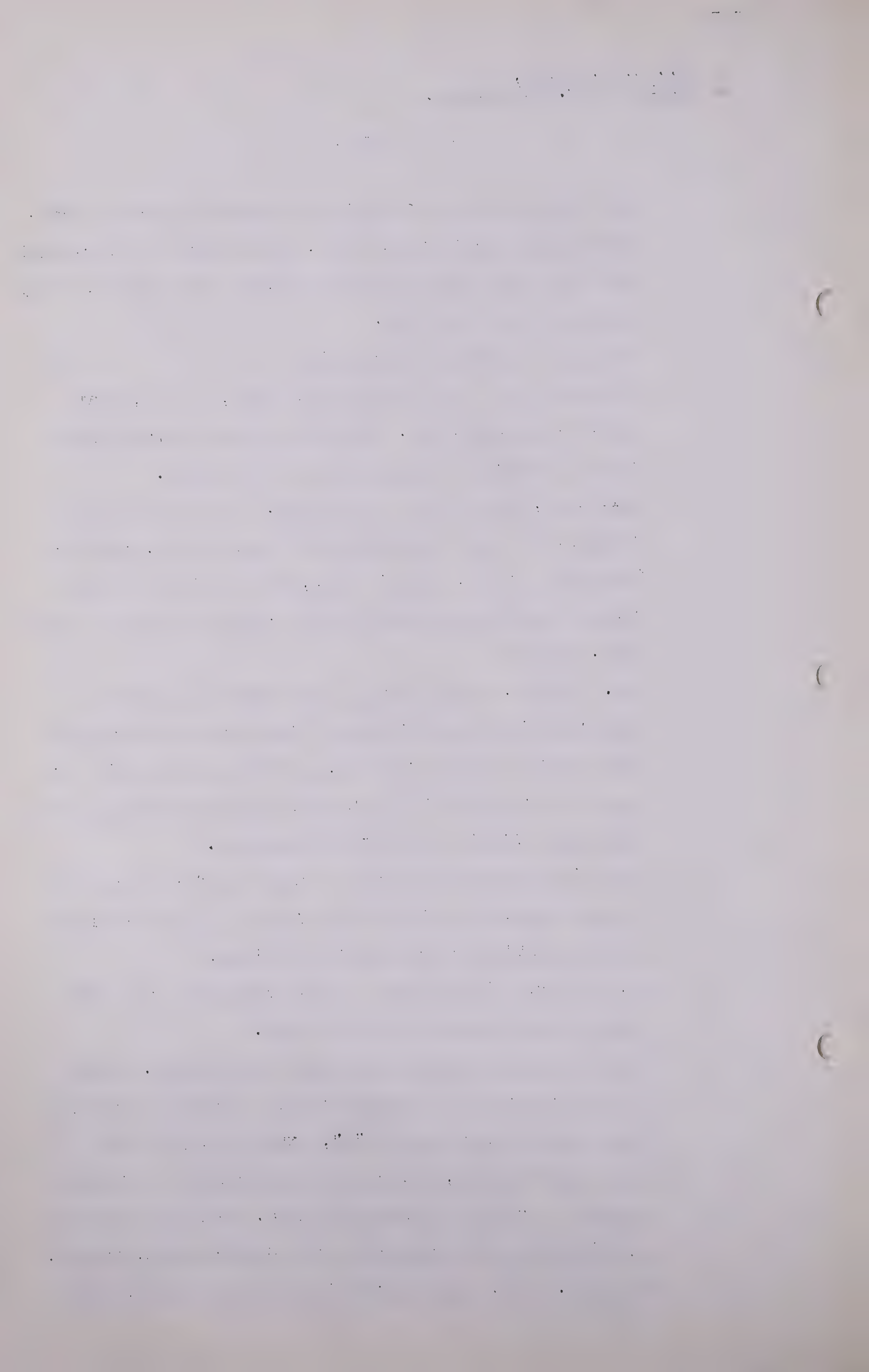
Q Well then, let me put it this way. If it were a big company, and they are supposed to have money, whether they have or not, I don't know, but if it were a big company would you expect them to complete that as a gas well, Doctor?

A Yes, I would, because they could afford to invest in that casing and wait for maybe four or five years until they started to sell the gas, but these people did not have the prospect of selling that gas immediately so they could not afford to make the investment.

Q But this business of "status - abandoned", we are not to put any emphasis on that in so far as a question of reserves should be concerned for Big Lake?

A No. You can either drill a well alongside or go into the old hole and drill out the pipe.

Q Just one other question and then I am through. Maybe it is perhaps that I happen to live in Calgary and my cook stove is here but in "A", Exhibit 4, you have, if I may use the term, allocated a vast number of fields to what is called the Edmonton area. Can you tell us anything else with respect to the Calgary area, namely, Cessford, Olds, two others? You have no other fields



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they have missed here that they might get, in your opinion?

A This is not an allocation. I am not sticking my neck out on allocations.

Q You divide it into Edmonton area and Calgary area.

A Well, we were asked first to calculate the reserves within 100 miles of Edmonton, which we did, and then we added to all those fields within 100 miles in a direct line with Edmonton the field of Provost.

Q You mentioned that.

A Which is within 55 miles of the Northwest Utilities line. Then those fields south of that area we allocated - we said were in the Calgary area.

Q You do not like "allocated", I take it?

A Well, I am not going to take the responsibility of allocating fields.

Q Have we anything more than what you have mentioned that could be put in the Calgary area, I will put it that way? I do not mean by taking something away from Edmonton area. I was wondering if you have any knowledge of any other fields that might be included in Calgary?

A The Pendant d'Oreille is in already, and Many Islands.

Q Oh, do not bother further.

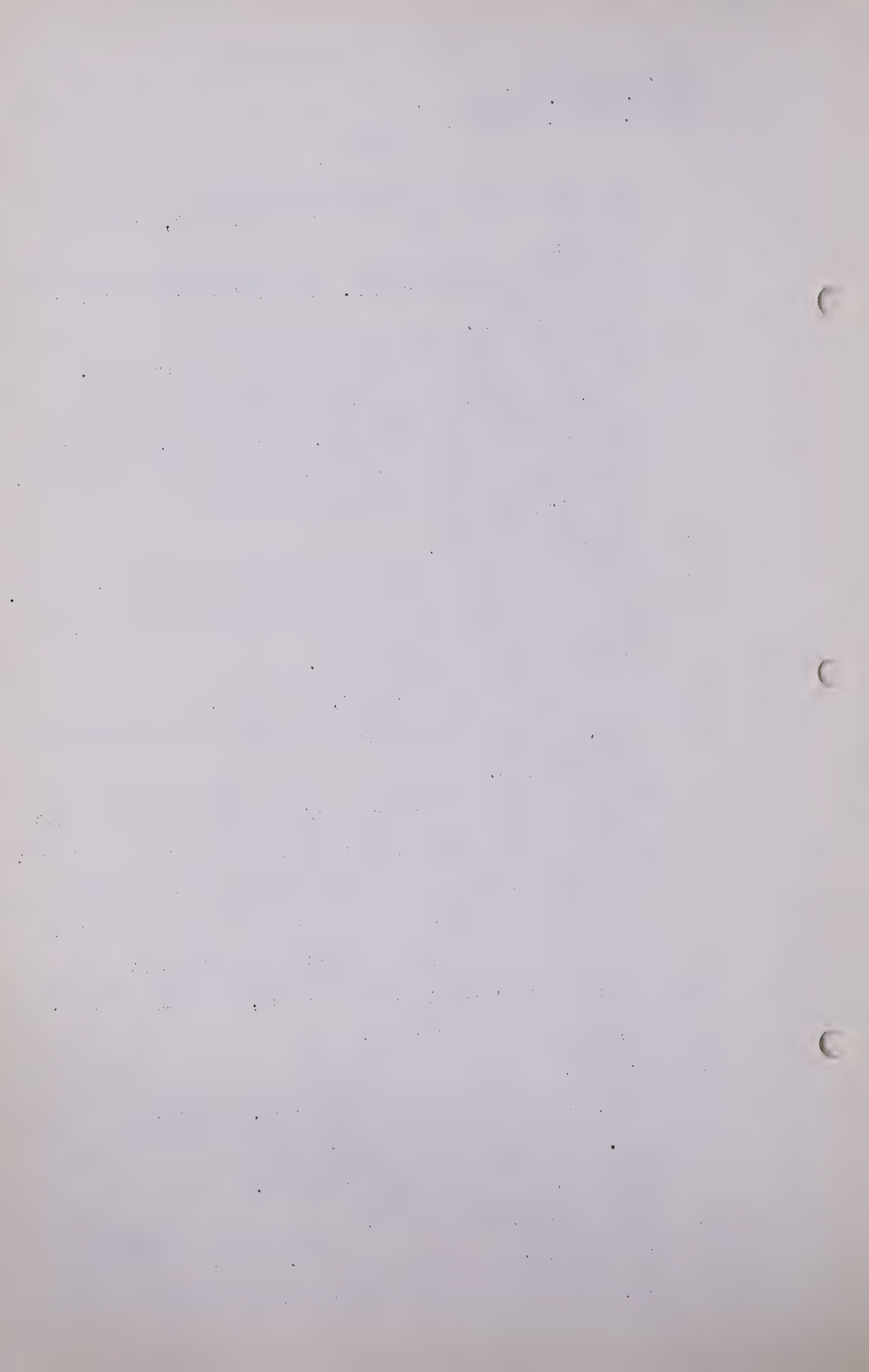
A Sibbald, I think.

Q Well, we transferred that yesterday, I think.

A Yes. Drumheller could be included but that was a prospect, there is a gas well there.

Q Don't bother, that is all.

Q MR. GOODALL: Dr. Nauss, in answer to Mr. Smith you said that you consider that there were



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five new fields, or should I say, gas pools within the Province in which the reserves are proved beyond a reasonable doubt, is that right?

A Well, I did not use those words.

Q That is approximately correct?

A Yes.

Q Do you think there would be enough gas pools proved, and I would say developed in Lower Cretaceous zones within the Province with an average size or acreage which could be taken as a basis for one or several rather than just arbitrarily 2,000 acres or 1,000 acres?

A Well, we feel that 2,000 acres is possibly that average. You see, that is the point that I have been trying to make.

Q Have you actually tried to work it out, that is what I was wondering, if you have any basis for that 1,000 acres?

A You can not do it because there is a very unfair - it is unfair due to this fact, that there are very few Cretaceous fields developed to the extent that we know their size.

Q Have you any idea how many there would be?

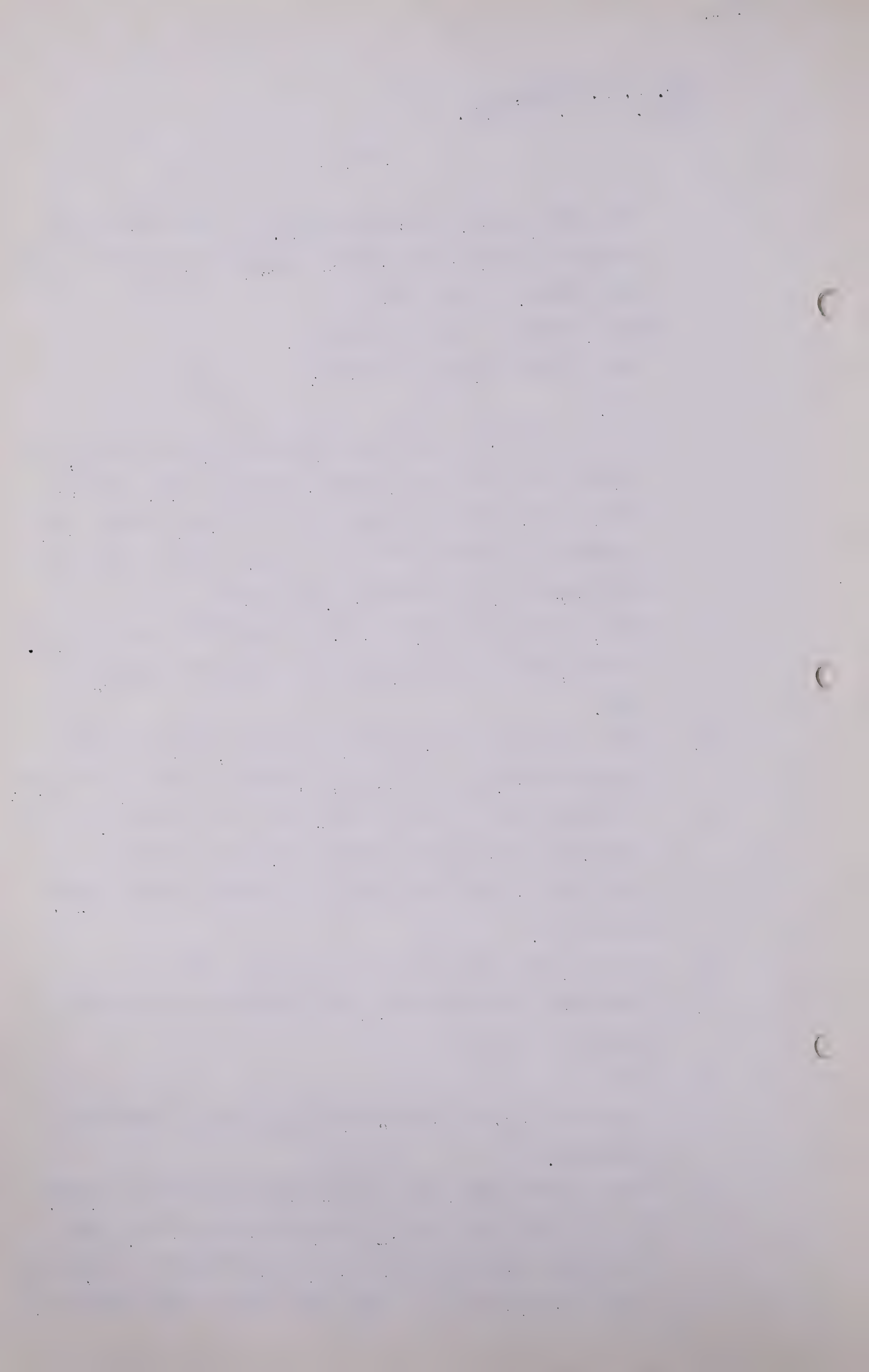
A That have been developed, Lower Cretaceous pools that we know their size?

Q Yes?

A I know of no Lower Cretaceous pool that is completely developed.

Q That is just what I was wondering, if it could be used.

A No, I do not think you can because of that fact, that the Lower Cretaceous pools are not developed to the extent that you would know the area of a large enough number of



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them to get an average size.

Q To get representative values?

A Yes.

Q In your submission you mentioned quite a few drill stem tests and I see there is a recovery of water. Do you place any significance on the amount of water recovered in those, or is that just an indication that there was water present?

A Well, sometimes the drill stem tests taken has a little bit of water and they continue testing below that and get gas. We have considered that some of that water may not be serious.

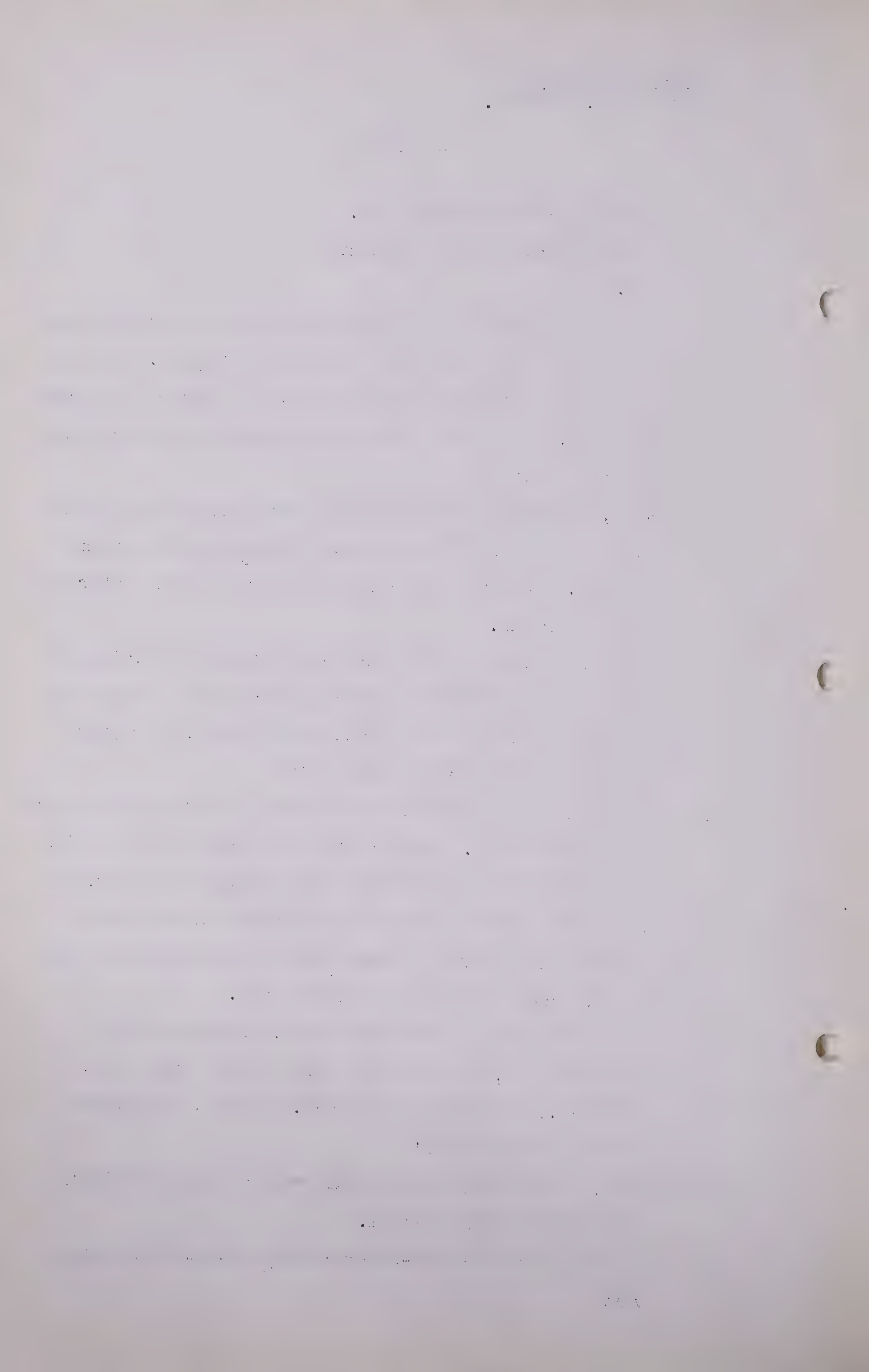
Q I was wondering if there was any information available to you on the amount of water produced with the gas and if that recovery in the drill pipe might not be just what is left when they tested it?

A Oh, yes, in very few instances have they flowed water in any large volume. In very few instances in these drill stem tests have they flowed large volumes of water, and in any case where they have salt water in more than several hundred feet of salt water in a drill stem test we have taken that as the water level.

Q I just happened to have this open, information on Bolloque Lake, the interval 2894 to 2910, "gas flow 1690 Mcf., decreasing to 84 Mcf. per day. Recovered 450 feet salt water."

A Well, I would say that is salt water which definitely indicates the water level.

Q You would say the gas-water contact was in that interval?



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A Yes, it is within that interval.

Q The reason I am asking you this, Dr. Nauss, is there has been such a wide variation in some instances in our past hearings on estimates of thickness of sand or thickness of pay zones by various witnesses. I was wondering if there might not be some closer agreement where you have some factual data, such as cores, drill stem tests and electrologs. We can hardly see the reason for such a wide variance in opinion.

A Well, take this drill stem test here, the test was from 2894 to 2910, which is a thickness of 16 feet.

Q Yes?

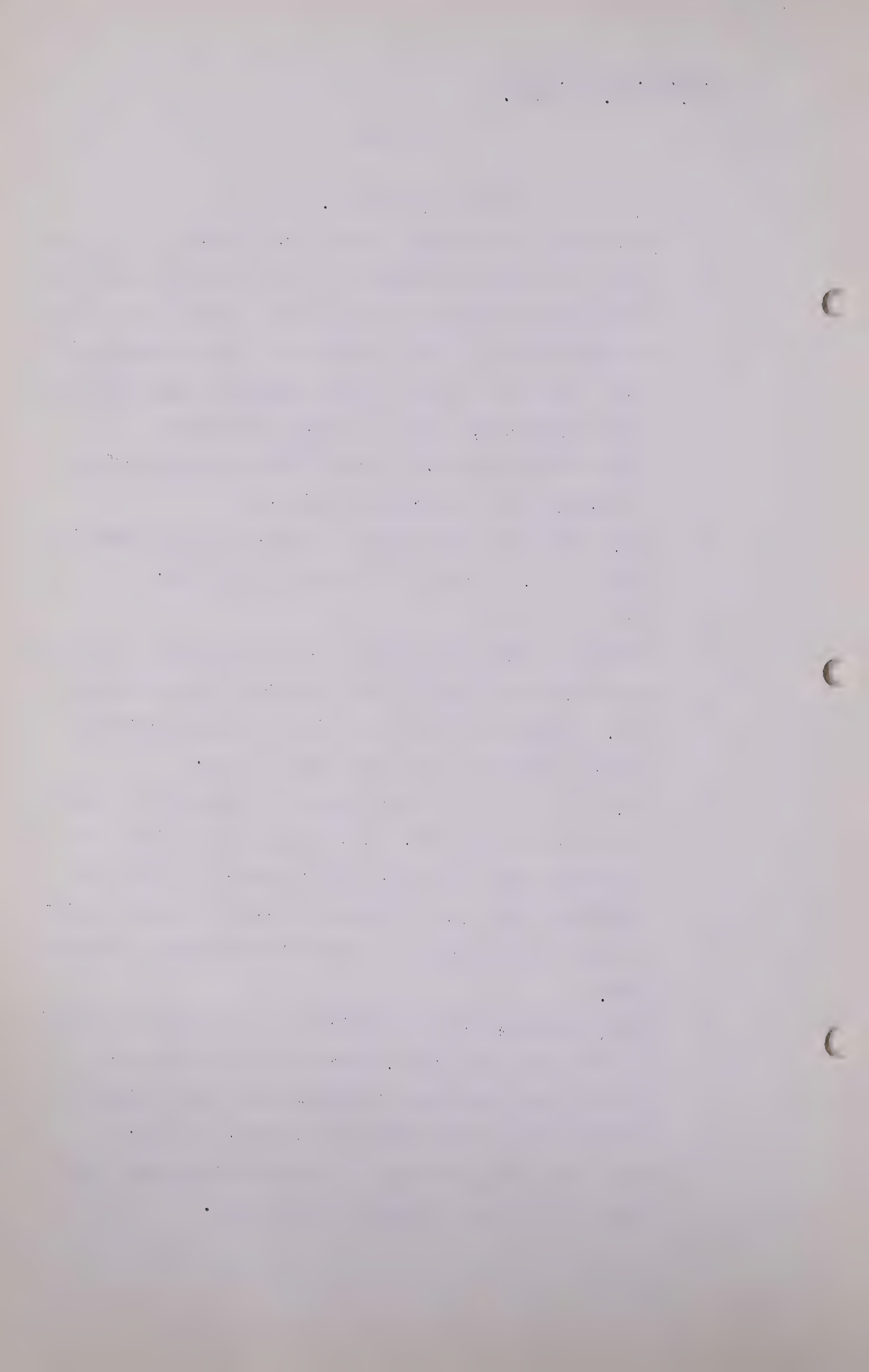
A The top of that drill stem test, we will say, is in the gas zone, the bottom of that interval is in the water zone. Somewhere within that 16 feet is the gas-water contact but you do not know exactly where.

Q Now, if you have the electrologs to compare with that?

A It may or may not show. If within that interval the electrolog shows the gas-water contact, then you have something to go by, although even with the electrolog - you can not measure it to within more than two or three feet.

Q Well, if the electrolog indicated the presence of water in that zone about 2894, which would you rely on?

A I think you would take the drill stem tests because they did have a very substantial flow, you see. I think you would be forced to take the drill stem test because it is more concrete information.



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Q You prefer the electrolog?

A In this instance, because we did get 1,690,000 cubic feet, and in quite a number of instances the electric log does not show the water level.

Q Yes. I think that is all I have, Dr. Nauss.

EXAMINATION BY DR. GOVIER:

Q Dr. Nauss, there are two or three points. One of them is a very small one. You explained yesterday that you had revised the basis of assessing one of your columns of gas reserves to gas in place?

A Yes.

Q Now, I take it that is the actual number of cubic feet of gas in place expressed in terms of standard conditions?

A That is right, measured at a pressure of 14.4 pounds and at a temperature of 60°F., and it is different from the so-called gas in place presented by Dr. Hume in his report. Actually, his figures are not gas in place but gas to an abandonment pressure of 14.4 pounds.

Q That is fine. That is the thing I wanted to get cleared up. So that your figures are just slightly different than Dr. Hume's figures?

A That is right. It is one atmosphere of pressure different.

Q Another point, Dr. Nauss, I notice in scanning Plates 1, 2, 3, 4, etc., that you have used an 80% recovery factor for a great many, I think by far the majority of the fields, and you seem to have done this despite the fact that there is a variation of over 10-fold in thickness, over 100-fold in area, and over 4 or 5-fold in pressure?

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A Yes.

Q Do you think it reasonable that the percentage of recovery would be the same despite those wide variations?

A No, it would not be identical, but since the percentage of recovery is the thing so difficult to predict, I do not see any point in going into any great detail, which is what we decided not to do. We decided not to go into the percentage of recovery in great detail.

Q I can understand that, Dr. Nauss, but do you believe that it is proper to assume an 80% recovery from a very thin sand, say a 6-foot sand?

A If there is not salt water immediately under the 6-foot sand, yes, I think it is quite all right, but if it is resting on salt water then I would say it was very wrong.

Q Are there not some of them where the sands are resting on salt water?

A Yes, there are, but I think in no case do we have a 6-foot sand. Were that gas resting on salt water we would not class that as a reserve.

Q I notice there are some very thin sands, I am not quite sure where they are?

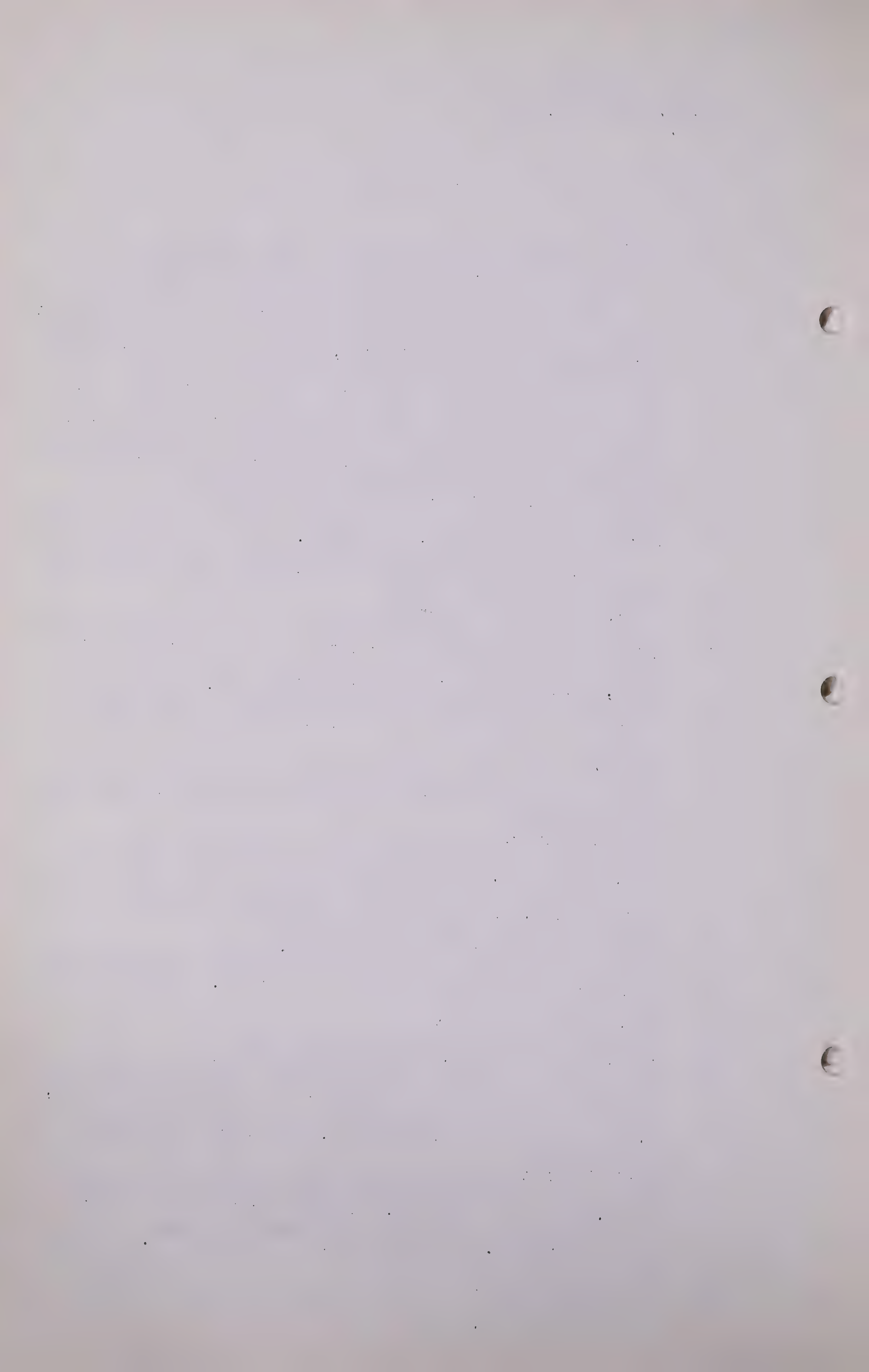
A Where the sand thickness was very small.

Q What about Craigmyle with an 8-foot sand in the Viking, Dunmore with two 7-foot sands, and Black Butte with a 6-foot sand?

A Well, most of those are, the gas occupies the entire sand thickness. They are thin lenses of sand.

Q No bottom water?

A No bottom water.



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Q Do you recall, Dr. Nauss, when, I think it was, Mr. Davis presented the records of a large number of fields in the United States and gave us ideas of the overall percentage of recovery from those now near-depleted fields?

A Yes, I remember the percentages were quite high.

Q As I recall, they varied over quite wide ranges, did they not, from 65 to 70 and to over 90 in cases?

A Yes, they did.

Q Do you still think that it is sufficient for our purposes to consider a flat figure, Dr. Nauss?

A This is more or less an average figure all right, and you have a just criticism there, since you mention right there that those figures vary from 60 to 90, well, then, the using of an 80% figure for all of them or for many of them is a good average figure.

Q You think that preferable to trying to apply judgment to individual cases and take into account the sand thickness, the nature of the formation and so on?

A No, I do not think it is preferable. To go into all the details of it would be preferable, all right. I do not think that the work involved to us, at least, would warrant the additional accuracy.

Q It probably would not affect the over-all total, it might affect individual pools?

A It would definitely affect individual pools but would not affect the over-all total to any extent. We were pressed for time.

Q There is another matter, Dr. Nauss, and it is a very difficult one, and that is the question of proven and probable gas that we have discussed in these Hearings.

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I certainly appreciate your reluctance to differentiate between the probable and proven gas in any way.

A It is not a matter of reluctance, it is a matter of creating or grouping them into the different classifications of reserves, proven, probable and possible, as I think that is a very unscientific way of doing it, and I think we should have a more accurate one.

Q And for that reason you are reluctant to use that method?

A Yes.

Q I appreciate it, Dr. Nauss, but I would ask you to consider the position that the Board are in. We must reach for a realistic figure.

A That is right.

Q We must find a figure for that gas whose existence and amount can reasonably be counted upon. Would you agree with that?

A Yes.

Q But that is our job?

A Yes.

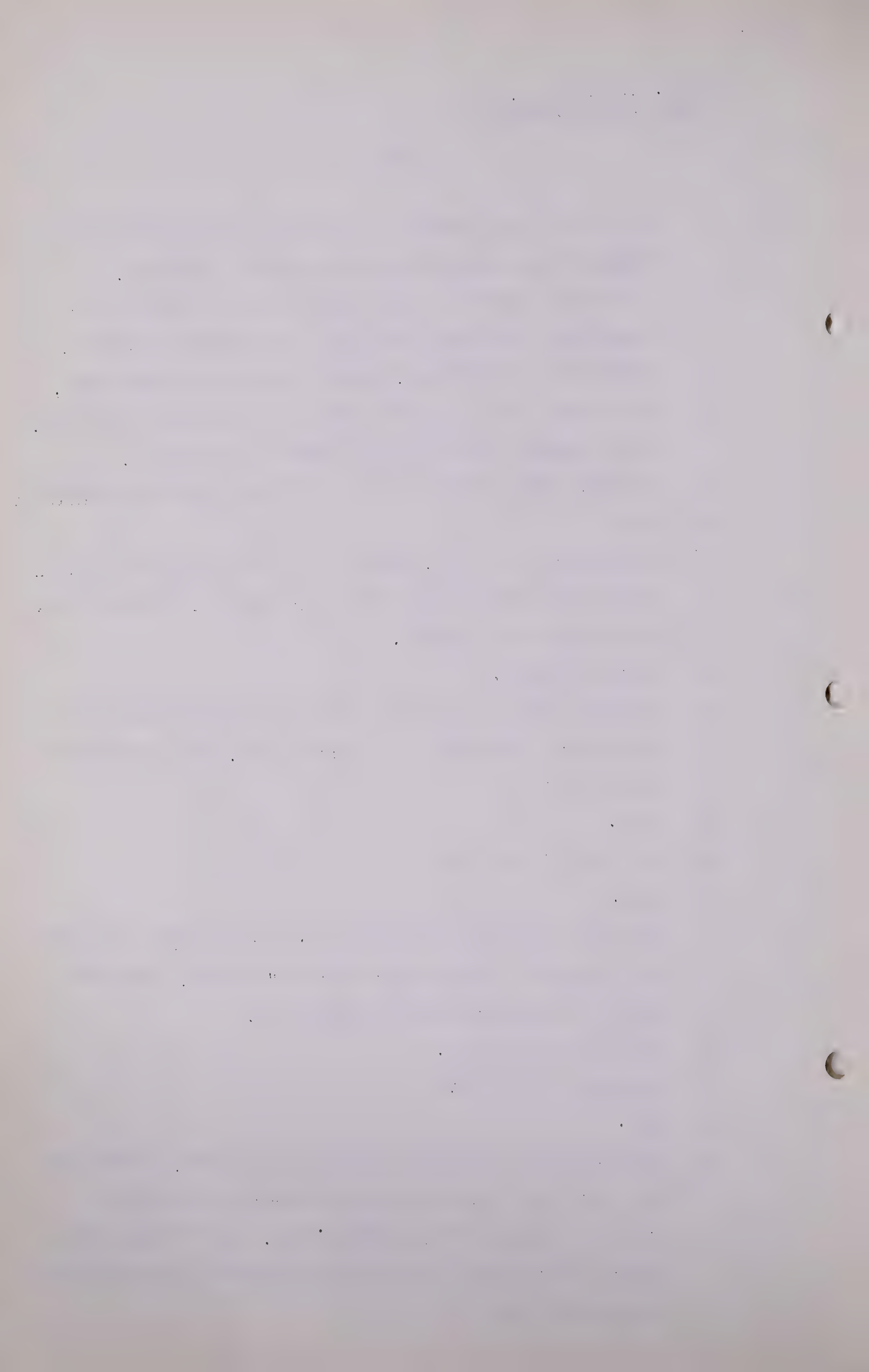
Q Gas whose existence and amount can reasonably be counted on. We won't use the word "proven" at all, just talk about it being reasonably counted on.

A Yes, I would say so.

Q We have to do that?

A Yes.

Q Now, when you consider that that is our job, I still am not sure that I am properly interpreting your last column of figures in your Exhibit 4. Is it right that those figures take no account whatsoever of the economics of gathering gas?



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- A These take no account of the economics of gathering the gas or picking it up from the field and bringing it into some large transmission line or to some market.
- Q And is it also right that the figures make no distinction between gas which is distant a great many miles and gas which is quite near a market?
- A That is right, no distinction between them in the report.
- Q And the figures also include gas estimates which must take in all degrees of certainty from what people might call proven to what some people might call probable or even possible?
- A No, there are no reserves in here which are considered as possible, no. We did not go that far.
- Q But all degrees of certainty between, say, proven and probable?
- A Well, let us look at it more specifically. The information involved in calculating gas reserves were drill stem tests, production tests, core analyses with porosity, connate water, and the measurement of the pressure. The electric log to help you in determining the thickness. An examination of the cores and samples to help you determine the thickness. Structures indicated by the large number of wells drilled such as in the Viking-Kinsella field. The configuration at the top of the sand, in the Viking sand, because there was a large number of wells drilled. The structure as indicated by seismograph; structure as indicated by surface geology; and structure as indicated by any other means. Those are most of the items. Oh, temperature measurements at the bottom of the hole, and the measured

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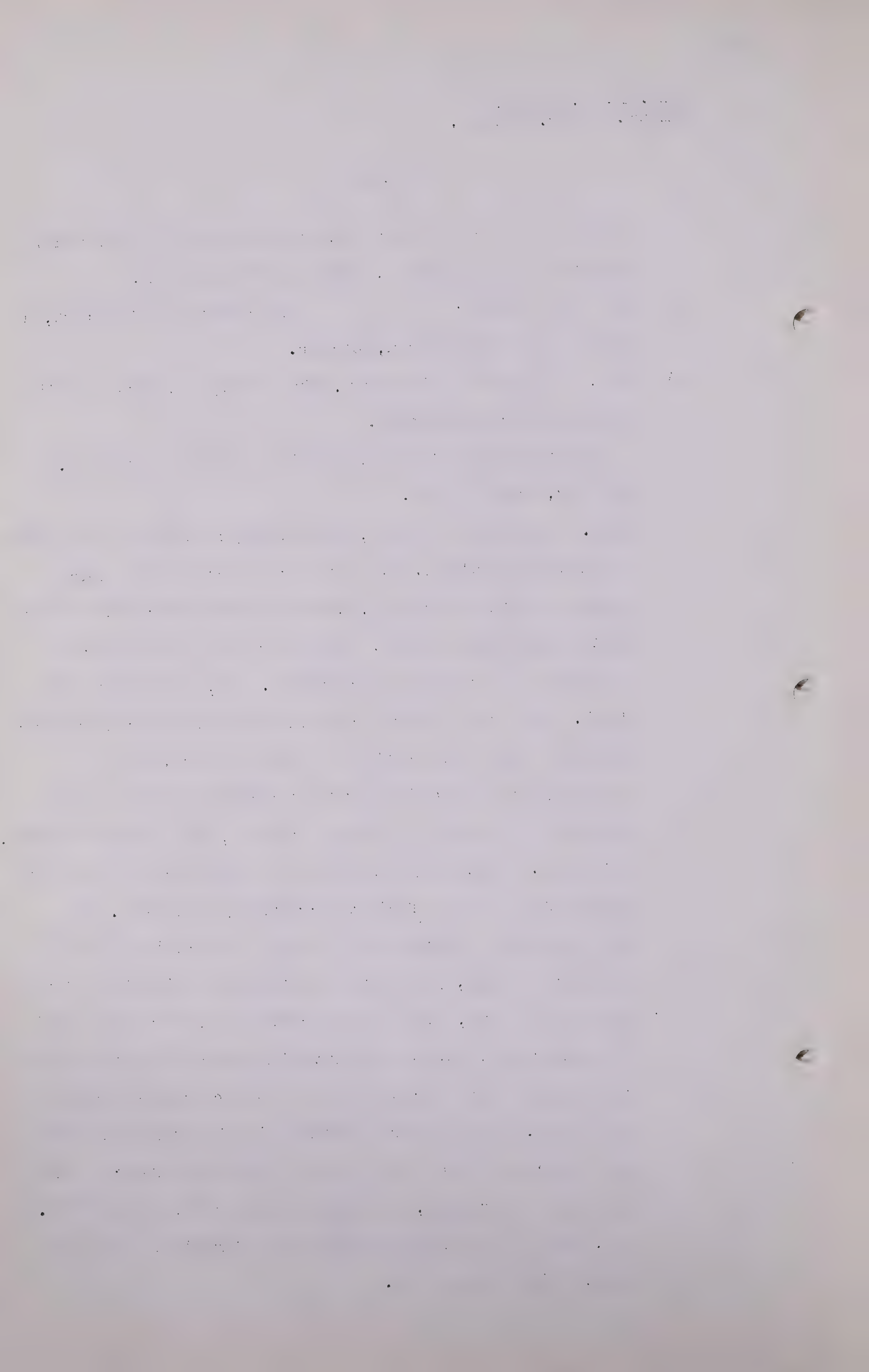
deviation factor in one and the calculated deviation factor in other cases. Those are the items.

Q MR. C.E. SMITH: As a matter of record, I think you forgot area, Doctor.

A No, in regard to the area, that is what I meant by the structure contour maps.

Q I was thinking of what was going down in that book, Doctor, that is all.

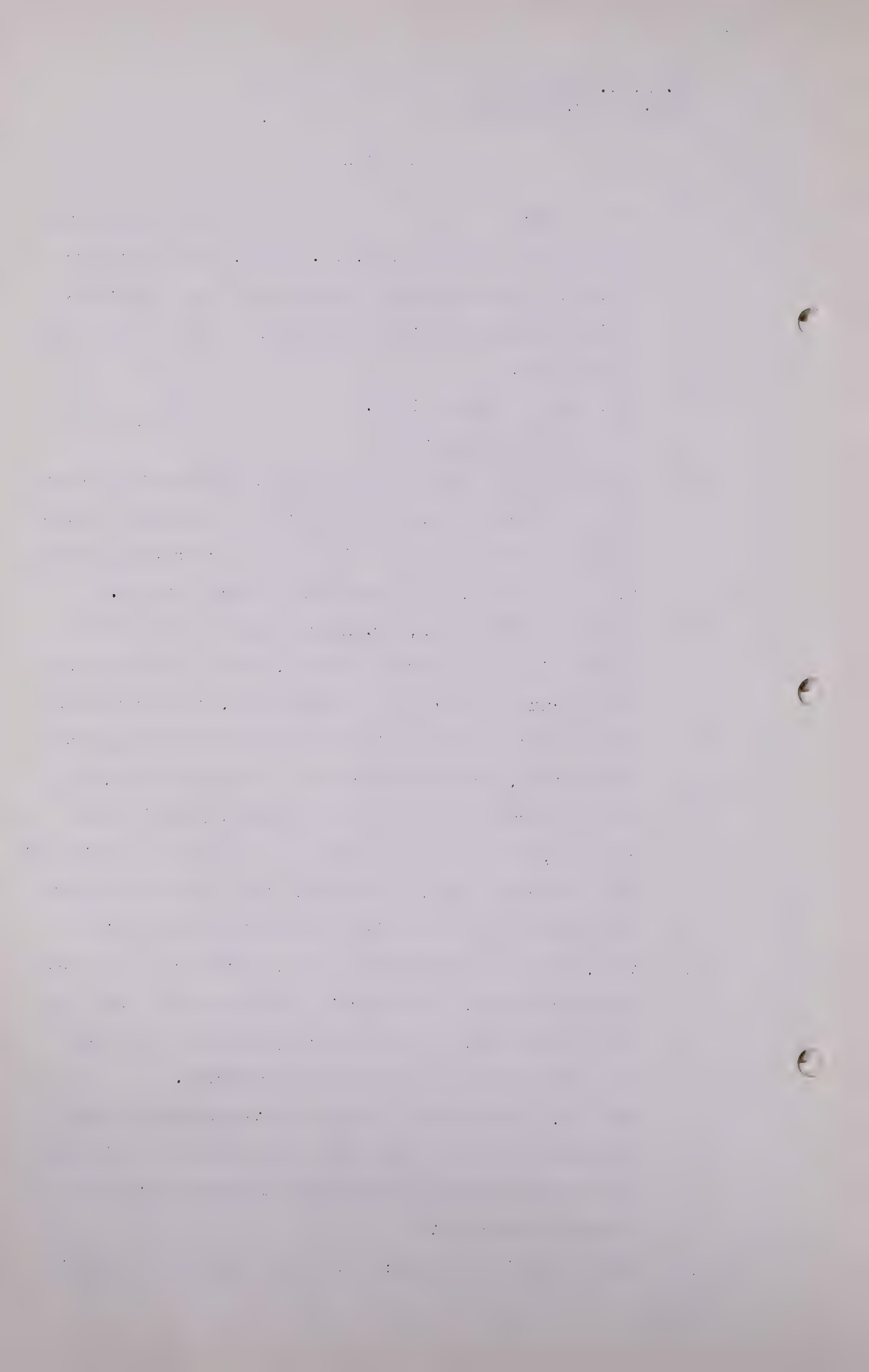
A Yes. In regard to area, that would be based on the best area determination. We got our outline by the large number of wells drilled, where the structure was determined from those wells. Those are the items which go to make up a reserve calculation. Oh, in addition to that, there are reserve calculations by material balance, which we have very little of that in here. The accuracy and reliability of your reserve calculation depends on how many of those factors, those measurements, you have. Now, only in one or two instances do we have every one of those factors accurately measured. So that in every instance we have the indication of the presence of gas, you have to have the indication of the presence of gas, and the indication that that gas will be commercial. We do not have the proof that those are commercial wells because we have not completed them as gas wells, but in every instance in this table we have the indication that those wells will be commercial and that gas is present, so that we have drill stem tests. Now, that is the least amount of information that we have, drill stem tests.



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- Q DR. GOVIER: But I think it would be fair to say, would it not, Dr. Nauss, that there are virtually all gradations between what you consider a minimum amount of data up to what you are really quite happy about?
- A Yes, that is quite right.
- Q To almost a maximum?
- A In this table there are all gradations between a 1-well pool in which we have no information and only a series of drill stem tests to a field like Turner Valley that has been calculated by material balance methods.
- Q It would follow then, Dr. Nauss, that if it is the Board's job to determine the gas, whose existence and amount can reasonably be counted upon, the Board will have to set up some sort of standards for making that segregation, or that selection, and then in applying those standards to your list of wells, your list of reserves, and since the degree of precision is different for different items, is it right that you would expect the Board to come out with a segregation of yours?
- A Well, it is our idea that these reserves can reasonably be counted upon. The Board's problem is how sure does the Board think, or the Board's problem is how sure does the Board have to be of its reserves.
- Q That is, you say that despite the variations in the precision of these items, in your opinion all of them are reserves whose existence and amounts we can be reasonably sure of?
- A Let us put it this way: The total figure at the end



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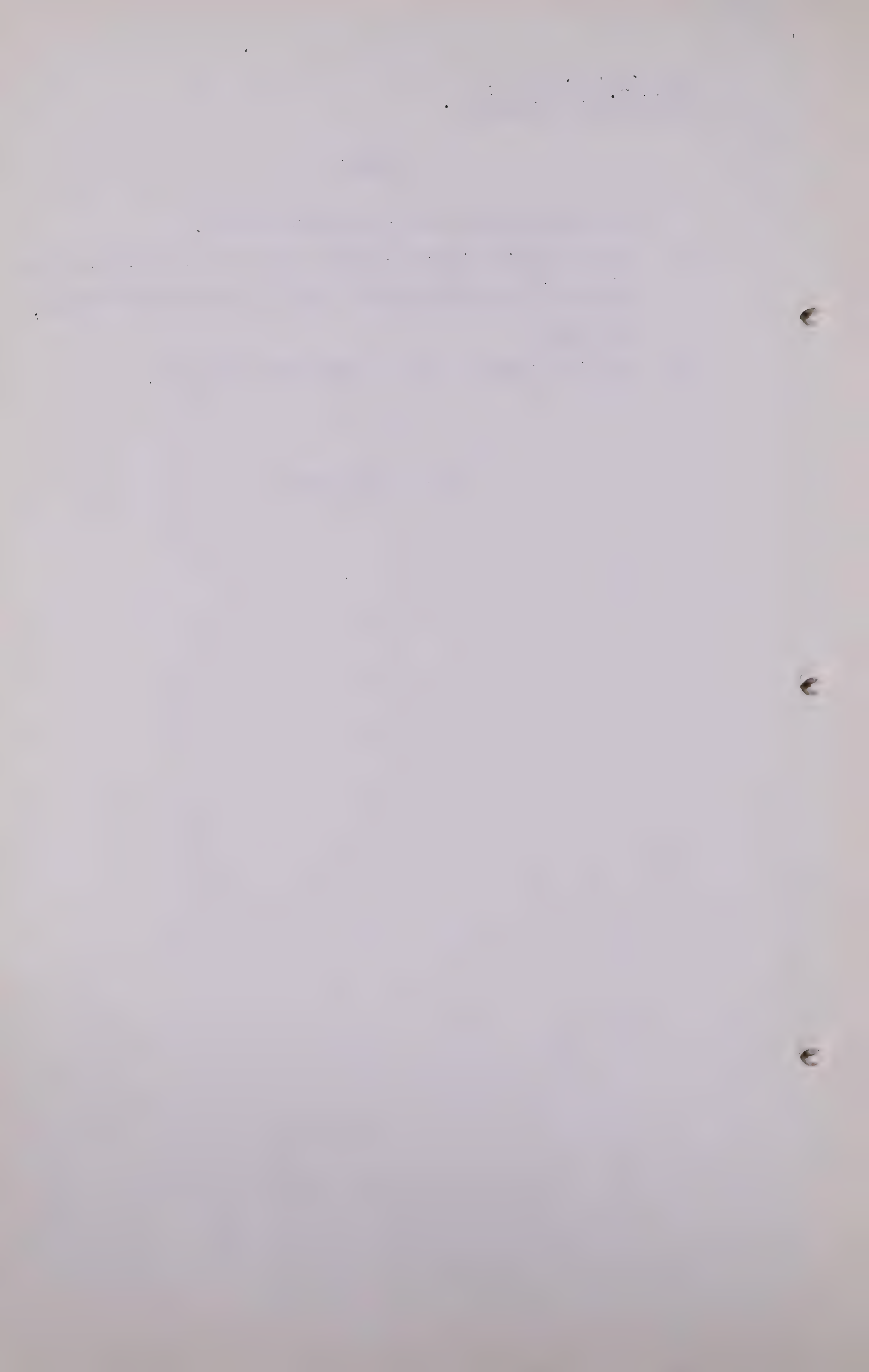
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is an amount that can be counted upon.

Q It may be, Dr. Nauss, that we have to consider more than tables; I think we have to look at individual fields, don't we?

A Yes, you have to look at individual fields.

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Q What I am trying to arrive at is this, Dr. Nauss. Is it your recommendation to the Board that we accept this last column of figures of yours as gas whose existence and amount we can reasonably depend on?

A Yes, that is our recommendation.

Q Despite the fact some of them are apples, some are oranges and some bananas, in respect to the figure you present you add them all together?

A Yes, that is right.

Q Hoping in the average they will equalize?

A In regard to the over-all figure we expect that any deficiencies on the one hand will be made up for by the overage of the other.

Q And that also applies to the economic factor which you have not included here?

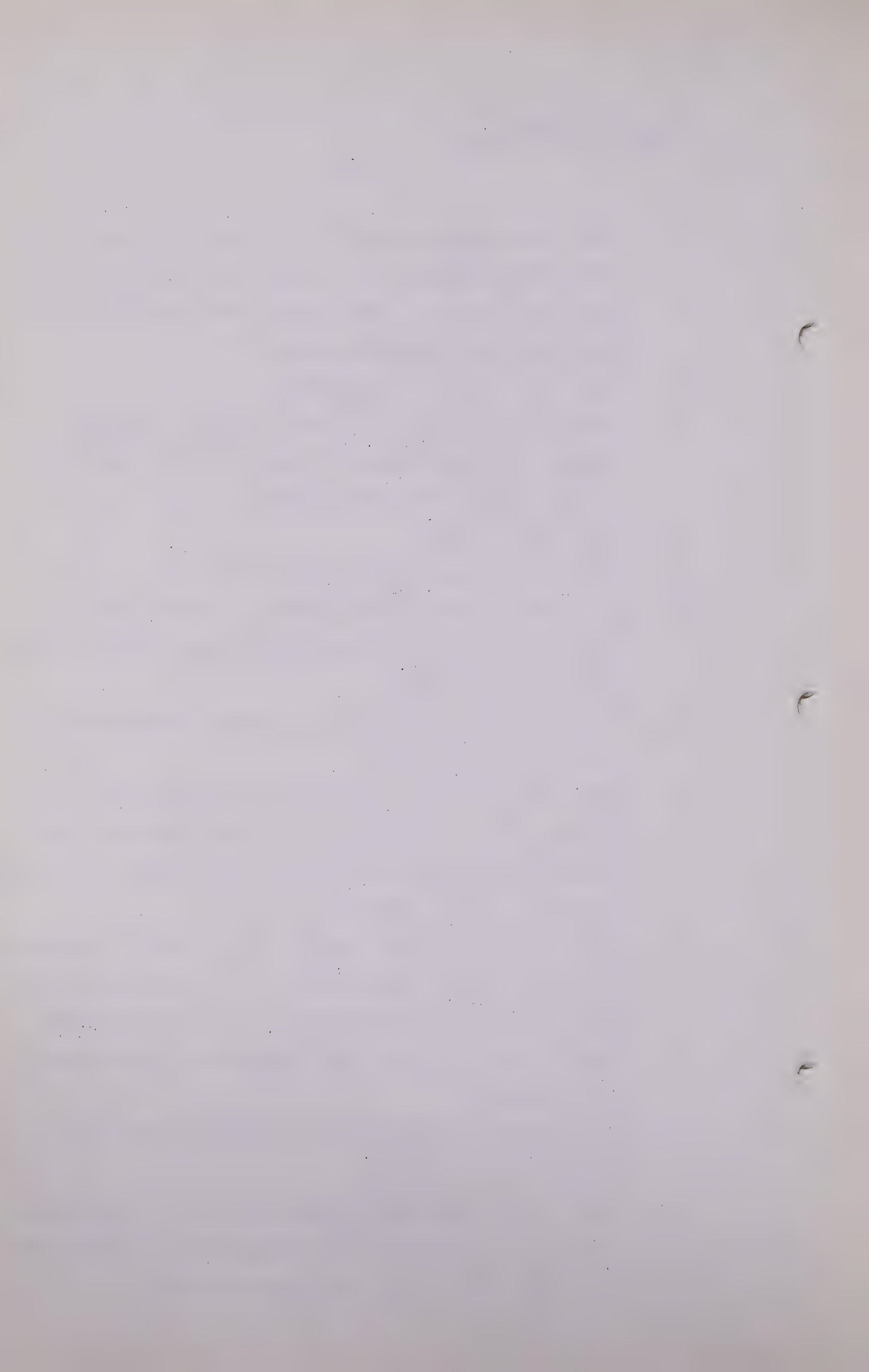
A Well, there will be a submission on economic factors.

Q I mean, in our totalling up of the gas which we can reasonably count on should we add any amounts for fields which may not be economic?

A No, I do not think you should. If a field is uneconomic it should not be added in, no. It is not gas that you can use except in an emergency. If you were running short of gas you would start using some of the fields like Redwater.

Q At the present time you do not consider Redwater an economic source of gas?

A Not with the abundance of gas that there is in Alberta. The only reason Redwater reserves are to be tossed out is because there is so much gas in Alberta.



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Q Yes, I see the point. Economics depends on the amount of competition from other sources, of course?

A So that if we are worried about the supply of gas we should include Redwater.

Q MR. C. E. SMITH: Or let us turn to coal, I suppose, Doctor?

A No, Redwater gas is better than coal.

MR. C. E. SMITH: I will say at the price.

THE CHAIRMAN: Then we will adjourn.

(At this stage the Hearing was adjourned until 9.30 A.M. 12th September, 1951.)

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